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REPAIRS

OF

RAILWAY CAR EQUIPMENT

WITH

PRICES OF LABOR AND MATERIAL.

A REFERENCE BOOK FOR RAILWAY OFFICIALS, WITH AVERAGE SHOP COST OF REPAIRS TO PASSENGER AND FREIGHT CARS.

DETAIL BILLS OF MATERIAL FOR CARS, TRUCKS, PLATFORMS, ROOFS, DOORS, ETC.; TABLES OF WEIGHTS OF IRON AND OTHER MATERIAL; BOARD MEASURE; SIZES AND WEIGHTS OF BOLTS, NUTS, WASHERS, NAILS, TIN, ETC.

BY

H. M. PERRY, M. C. E.

CHICAGO:
THE RAILWAY AGE,
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PREFACE.

After an experience of over thirty years in railway car work, and recognizing the growing necessity of a book devoted entirely to the subject of car repairs, it is the purpose of the author, in offering this work to the railway fraternity, to furnish a ready means of reference on this subject; especially for estimating the cost of repairs, making out damaged car reports, checking up bills, comparing the different methods of doing work, making out bills of material, etc.

The prices for both labor and material are based, as far as possible, on the Master Car Builders' Code of Rules governing repairs to cars, thus making them applicable to any section of the country, and damaged car reports based on these prices would not only be correct, but when made out by different employes would be approximately alike.

The useful information, such as tables, and weights of all classes of material, has been carefully compiled, and is intended to cover all the information required to answer the various problems arising in car-shop work.

H. M. P.

AVERAGE COST OF REPAIRS
TO
STANDARD PASSENGER EQUIPMENT.

These prices include the labor of removing old material, and the labor and material for replacing new, unless otherwise specified.

	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
Removing old siding, filling between studs, renewing siding and mouldings, burning off letter board and posts and finishing ready to paint, 340 hours			$85 00	
Whitewood lumber	1462 feet.	$38 00		
Ash "	300 "	9 00		
Total cost ready for paint				$132 00
or about 25c per sq. foot.				
Repairing surfaces of 100 sq. feet or less, filling in frame, siding, and painting, estimate 60c per sq. foot.				
Removing and replacing siding but *not* filling in frame, burning off old paint and finishing car ready for paint, 100 hours			25 00	
Whitewood lumber	750 "	19 50		
Ash "	300 "	9 00		
Total cost ready for paint				53 50
or about 10c per sq. foot.				
Repairing surfaces of 100 sq. feet or less, siding and painting, estimate 45c per sq. foot.				
Painting car outside, complete, costs about 25c per sq. foot.				

REPAIRS TO PASSENGER EQUIPMENT—CONTINUED.

	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
Burning off old paint and finishing outside of car ready for paint, 100 hours				$21 75
Removing and replacing belt rail	160 feet.	$ 5 00	$ 8 00	13 00
Length of car costs about 12½c per foot.				
Shorter lengths " " 25c "				
Removing and replacing letter board, crown moulding and fascia	200 "	6 00	12 50	18 50
For painting, estimate 25c per foot.				
" lettering, " 15c per letter, gold.				
Repairing short lengths — for woodwork painted and varnished, estimate 60c per foot, with 15c per letter extra for gold letters.				
Baggage and mail cars cost about the same as coaches for the same class of work.				
Tinning roof, complete, copper flashing	652 "	41 24	22 76	64 00
" " lower deck, " "	367 "	28 02	12 48	40 50
" " upper deck	285 "	13 22	9 28	23 50
Canvas roof, complete, copper flashing	73 sq. yd.			48 00
Copper flashing	60 lbs.	11 50		
Tin roof, complete, copper flashing, per sq. ft.				10
" " without " " " "				08
Canvas roof, " " " per sq. yard.				50
" " with " " " "				66

REPAIRS TO PASSENGER EQUIPMENT—CONTINUED.

	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
Removing "Miller" platform timbers and replacing new, using old castings and forgings, one end of car	340 feet.	$18 00	$12 00	$30 00
Removing and replacing same platform	48 "	1 20		10 00
End sill, including removing and replacing platform, and siding ready for paint	68 "	2 00	15 00	18 20
Siding and moulding one end of car, complete	68 "	2 00	3 00	5 00
Painting and varnishing " " "				22 00
1 door post, removed and replaced new	20 "	60	4 40	5 00
1 corner post, " " " "	20 "	60	4 40	5 50
1 end carline, " " " "	25 "	75	2 50	3 25
1 " corner, " " " "	6 "	18	2 50	2 63
2 " " " " " "	12 "	36	5 00	5 36
1 " arm, " " " "	16 "	50	2 50	3 00
2 " " " " " "	32 "	1 00	5 00	6 00
1 end carline and 2 corners removed and replaced new	37 "	1 10	5 00	6 10
1 end carline and 2 corners, and 2 arms removed and replaced new	69 "	2 10	10 00	12 10
Removing and renewing hood, complete		10 00	20 00	30 00
Splicing roofing at end plate, lower deck	20 "	50	1 00	1 50
" " " " upper "	40 "	1 00	1 50	2 50
Lining underside of hood	33 "	1 00	2 00	3 00
Tinning hood, complete				5 00
" " lower deck				2 00
" " upper "				3 00
Canvas on hood, complete				2 50

REPAIRS TO PASSENGER EQUIPMENT—CONTINUED.

	Cost of Material.	Cost of Labor.	Total Cost.
Applying "Pullman" vestibule, including remodeling hood and platform, 1 end of car	$485 00	$190 00	$675 00
Applying vestibule after the platform and hood have been remodeled, 1 end	290 00	110 00	400 00
Removing old platform and applying new Janney-Miller platform to receive vestibule and crediting old material, 1 end	160 00	40 00	200 00
Removing old hood and applying a new one to receive vestibule, 1 end	35 00	40 00	75 00
1 end door, complete, mahogany, trimmed			24 00
1 set of glass and trimmings for 1 door			8 00
4 vestibule doors, complete, mahogany, 1 end			48 50
1 set of glass and trimmings for 4 doors			27 50
1 " " " beveled for 4 doors			10 50
1 vestibule door, mahogany, not trimmed			5 25
2 vestibule posts			6 50
1 " dome			9 50
1 " lamp			18 00
2 " steps, curved risers, not trimmed			8 00
2 sets bronze ornaments for step risers			6 00
Gear brake attachment, one end of car			25 00
Body hand rails, bronze, 1 end of car			7 50
Platform " " 1 " "			5 00

REPAIRS TO PASSENGER EQUIPMENT—CONTINUED.

	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
1 Miller platform, complete, new material		$63 00	$12 00	$75 00
1 " " new timbers, old material		18 50	12 00	30 50
1 end timber, 7 in. x 8 in. x 8 ft. 6 in.	45 feet.	1 12	1 50	2 62
1 step " 2½ in. x 10 in. x 3 ft.	7 "	18	50	68
1 inter " 4 in. x 12 in. x 14 ft.	66 "	1 65	1 00	2 65
1 center " 4 in. x 12 in. x 14 ft.	66 "	1 65	4 50	6 15
2 " " 4 in. x 12 in. x 14 ft.	132 "	3 30	5 00	8 30
Renewing all timbers, one platform	340 "	8 50	10 00	18 50
1 platform timber plate, ⅜ in. x 7 in. x 14 in.	125 lbs.	3 75	25	4 00
1 platform floor, 2 ft. 6 in. x 6 ft.	20 feet.	50	1 25	1 75
1 " step tread, 1½ in. x 9 in. x 2 ft. 6 in.	3 "	09	25	34
1 " " riser, ½ in. x 8 in. x 2 ft. 6 in.	1 "	03	15	18
1 " " side 1¼ in. x 18 in. x 3 ft.	7 "	21	50	71
1 pair steps, complete				2 50
2 platform hand rails, plain	43 lbs.			3 50
4 " " " pillars	42 "			2 00
2 body " " plain	13 "			1 00
1 brake mast	22 "			1 00
1 " " step	22 "			1 80
1 Miller hook, cast steel				12 00
1 " " spring	67 "			2 50
1 " " " pocket	43 "			1 50
1 " draw stem and key	14 "			50
1 " carry iron and plate	42 "			1 00
1 " uncoupling lever	25 "			1 50
1 " buffer	63 "			4 00
2 " safety chains, ⅞ inch				2 50

DETAIL COST OF APPLYING

"MILLER" PLATFORMS TO PASSENGER CARS.

Oak lumber, 680 feet @ $25.00	$ 17 00	
Ash " 36 " @ 30.00	1 08	
Yellow pine, 40 " @ 25.00	1 00	
Whitewood, 78 " @ 30.00	2 34	
		$ 21 42
FORGINGS.		
2 Miller hooks	$ 24 00	
2 " " yokes	3 00	
2 " " tail pins	2 00	
2 " " " bolts	25	
4 " spring pockets	5 50	
2 " " " yokes	60	
4 " " followers	1 50	
2 " uncoupling levers	3 00	
2 " " chains and clevises	1 00	
		40 85
2 Miller buffers	8 00	
2 " " followers	60	
2 " " keys	10	
2 " " face plates	60	
		9 30
2 brake masts and steps	3 00	
8 platform pillars	4 00	
4 " hand rails	7 00	
		14 00
2 coupling pins and chains	1 25	
4 safety chains, $\frac{7}{8}$ inch	4 50	
4 step angle irons and plates	1 10	
2 end sill truss rods	2 00	
		8 85
4 Miller hook springs	5 00	
		5 00
Amount carried forward		$ 99 42

DETAIL COST OF APPLYING

MILLER PLATFORMS TO PASSENGER CARS—CONTINUED.

Amount brought forward			$ 99 42
CASTINGS.			
2 Brake wheels	44 lbs.	$0 66	
2 " ratchets and pawls	18 "	27	
2 " mast guides	5 "	07	
8 pillar washers	16 "	24	
2 buffer followers	28 "	42	
2 " bushings	10 "	15	
2 draw bar stops	68 "	1 02	
2 " " pin holders	6 "	09	
2 lever wedges	3 "	04	
2 " guides	5 "	07	
4 " pockets	10 "	10	
4 truss rod struts	12 "	18	
			3 31
SPRINGS.			
2 Miller draw springs	24 lbs.	84	
2 " buffer "	24 "	84	
			1 68
MISCELLANEOUS.			
Bolts and nuts		3 70	
Screws and nails		2 20	
Paint stock		2 30	
			8 20
LABOR.			
Mill		2 50	
Car builders		20 00	
Painters		1 50	
			24 00
			136 61
Add 10 per cent			13 66
			$150 27

DETAIL COST OF APPLYING

JANNEY-MILLER PLATFORMS TO PASSENGER CARS.

Oak lumber, 600 feet @ $25.00	$15 00	
Ash " 36 " @ 30.00	1 08	
Yellow pine, 40 " @ 25.00	1 00	
Whitewood, 78 " @ 30.00	2 34	
		$19 42
FORGINGS.		
4 draw bar spring pockets	8 00	
4 " " " followers	2 00	
2 " " front yokes, ¾ inch x 4 inches	1 50	
2 " " chafe plates, ½ inch x 2½ inches	2 00	
4 " " " "	50	
2 " " stop braces	50	
2 " " lever springs	1 00	
		15 50
8 platform pillars	4 00	
4 " hand rails	7 00	
2 brake masts and steps	3 00	
		14 00
2 buffer face plates	1 75	
4 safety chains, ⅞ inch	4 50	
8 step angle irons and plates	2 25	
2 end sill truss rods	4 00	
4 draw timber straps	1 00	
		13 50
JANNEY-MILLER MATERIAL.		
2 Miller hooks, solid, No. 106		
2 combination horns, " 48		
2 eye bolts, " 67L		
2 " " " 66		
		36 00
Amount carried forward		$98 42

DETAIL COST OF APPLYING

JANNEY-MILLER PLATFORMS TO PASSENGER CARS—CONTINUED.

Amount brought forward				$ 98 42

JANNEY-MILLER MATERIAL—CONTINUED.

2 Janney couplers,	No. 1P			
2 " knuckles,	" 2			
2 " catchers,	" 3			
2 " catch spring bolts,	" 15			
2 " knuckle pins,	" 16			
2 " coupling pins,	" 17			
2 " tail pins,	" 18			
2 " horns,				
2 " " pins,	" 19			
2 " catch spring rings,	" 25			50 00
2 equalizers,	No. 6P		$3 00	
2 foot plates,	" 7		72	
2 combination yokes,	" 9		2 44	
2 " " bolts,	" 104		1 00	
2 draft bolts,	" 11		2 90	
2 fulcrum bolts,	" 12		1 70	
2 long T "	" 13		1 10	
2 short T "	" 14		1 50	
2 platform lever pins,	" 20		20	
2 catch levers,	" 22		1 28	
2 center buffer springs,	" 26		3 00	
2 draft springs,	" 28P		3 00	
2 Miller buffer guides,	" 29		1 60	
2 Janney " "	" 30		88	
				24 32
Amount carried forward				$172 74

DETAIL COST OF APPLYING

JANNEY-MILLER PLATFORMS TO PASSENGER CARS—CONTINUED.

Amount brought forward			$172 74

JANNEY-MILLER MATERIAL—CONTINUED.

2 center spring washers,	No. 32	$0 10	
4 fulcrum ferrules,	" 35	20	
4 thimbles,	" 37	10	
4 buffer washers,	" 38	20	
2 draw bar stops,	" 43	3 76	
2 " " bolts,	" 56	60	
2 combination buffers,	" 42	6 00	
2 buffer yokes,	" 44	2 86	
4 side spring plates,	" 45	1 76	
4 equalizer guides,	" 47	1 00	
2 side spring bolts,	" 52	1 00	
2 pull rods,	" 53	88	
2 side spring stirrups,	" 54	40	
2 side springs,	" 55	90	
2 platform lever plates,	" 57	10	
2 " " jaws,	" 58	50	
2 ball joint washers,	" 59	10	
2 side spring "	" 60	06	
2 swivels,	" 61	30	
2 " hooks,	" 62	50	
2 side spring triggers,	" 63	16	
2 connecting pins,	" 64	1 50	
2 trap door springs,	" 65	30	
2 trap doors,	" 68	2 20	
			25 48
Amount carried forward			$198 22

DETAIL COST OF APPLYING

JANNEY-MILLER PLATFORMS TO PASSENGER CARS—CONTINUED.

Amount brought forward			$198 22
JANNEY-MILLER MATERIAL—CONTINUED.			
2 platform levers,	No. 69	$4 10	
2 side spring pins,	" 81	10	
4 followers,	" 99	2 00	
4 " guides,	" 100	60	
2 Janney buffers, round face,	" 102	3 80	
2 " " flat "	" 103	3 60	
			14 20
CASTINGS.			
2 brake wheels,	44 lbs.	66	
2 " ratchets and pawls,	18 "	27	
2 " mast rests,	5 "	07	
8 pillar washers,	16 "	24	
4 truss rod struts,	12 "	18	
			1 42
MISCELLANEOUS.			
Bolts and nuts		10 25	
Screws and nails		2 50	
Paint stock		2 50	
			15 25
LABOR.			
Mill		3 50	
Car builders		30 00	
Painters		1 50	
			35 00
			264 09
Add 10 per cent			26 41
			$290 50

COST OF INSIDE FINISH.

Inside Finish, One End of Coach.

ONE END FINISH.

Lumber, mahogany, 103 feet @ 18c		$18 54
Labor, cabinet and mill	$ 5 50	
" painters and material	4 00	
		9 50
		28 04
Add 10 per cent		2 80
		30 84

Oak finish would cost $15.00.

ONE END DOOR.

Lumber, mahogany, 32 feet @ 18c		5 75
Labor, cabinet and mill	5 00	
" painters and material	3 25	
		8 25
1 door lock, bronze	4 00	
3 " butts, "	1 75	
1 " sash catch, bronze	25	
2 " glass	2 00	
		8 00
		22 00
Add 10 per cent		2 20
		24 20

Oak finish would cost $19.25.

ONE END DOOR CASING.

Lumber, mahogany, 25 feet @ 18c		4 50
Labor, cabinet and mill	4 00	
" painters and material	2 00	
		6 00
		10 50
Add 10 per cent		1 05
		$11 55

Oak finish would cost $7.50.

COST OF INSIDE FINISH—CONTINUED.

ONE GENTS' SALOON, COMPLETE.

Lumber, mahogany, 98 feet @ 18c		$17 64
Labor, cabinet and mill	$15 75	
" painters and material	5 50	
		21 25
1 door latch	4 50	
3 " butts	1 75	
2 top glass	1 00	
1 porcelain hopper	5 00	
1 " urinal	4 25	
1 " " pipe	75	
1 " drip pan	2 00	
1 hopper cover	1 75	
1 saloon handle	50	
1 " paper box	50	
		22 00
		60 89
Add 10 per cent		6 08
		66 97

Oak finish would cost $50.00.

ONE SECTION SIDE FINISH, 6 FEET.

Lumber, mahogany, 42 feet @ 18c		7 56
Labor, cabinet and mill	4 50	
" painters and material	5 00	
		9 50
		17 06
Add 10 per cent		1 70
		$18 76

Oak finish would cost $12.50.

COST OF INSIDE FINISH—CONTINUED.

LADIES' DRESSING ROOM WASHSTAND COMPLETE.

Marble slab complete	$16 00	
Porcelain wash-bowl	1 50	
		$17 50
Double acting pump, complete	15 00	
Trimmings	1 50	
		16 50
Lumber, mahogany, 30 feet @ 18c	5 40	
" white pine, 20 " @ 4c	80	
		6 20
Sheet lead, 15 lbs. @ 5½c	82	
" zinc, 15 " @ 5½c	82	
		1 64
Labor, cabinet	1 50	
" carpenter	1 25	
" painters	75	
		3 50

TANK.

Galvanized iron, No. 18, 74 lbs. @ 5c	3 70	
Solder, 4 " @ 14c	56	
Rivets, tinned, No. 4, ¼ " @ 36c	09	
		4 35
Water tank valve	2 00	
" " spider	05	
Brass spud, 1½ inches	72	
Galvanized union, 1½ inches	20	
		2 97
Labor, tinners		6 00
		58 66
Add 10 per cent		5 86
		$64 52

COST OF INSIDE FINISH—CONTINUED.

ONE DOUBLE WASHSTAND, COMPLETE.

Marble slab and back, complete	$27 00	
2 porcelain bowls	3 00	
		$30 00
2 double acting pumps, complete	30 00	
Trimmings	3 00	
		33 00
Lumber, mahogany, 66 feet @ 18c	11 88	
" white pine, 36 " @ 4c	1 44	
		13 32
Sheet lead, 20 lbs. @ 5½c	1 10	
" zinc, 22 " @ 5½c	1 21	
		2 31
Labor, cabinet and mill	7 50	
" carpenter	2 50	
" painters and material	1 75	
		11 75

TANKS.

Galvanized iron, No. 18, 110 lbs. @ 5c	5 50	
Solder, 5 " @ 14c	70	
Rivets, tinned, No. 4, ⅓ M @ 36c	12	
		6 32
Water tank valves, 2	4 00	
" " spiders, 2	10	
Brass spuds, 1¼ inches, 2	1 44	
Galvanized unions, 1¼ inches	20	
		5 74
Labor, tinners		7 00
		109 44
Add 10 per cent		10 94
		$120 38

COST OF INSIDE FINISH—CONTINUED.

ONE CORNER WASHSTAND, COMPLETE.

Marble slab and back, complete	$14 00	
Porcelain bowl	1 50	
		$15 50
Double acting pump, complete	15 00	
Trimmings	1 50	
		16 50
Lumber, mahogany, 50 feet @ 18c	9 00	
" white pine, 25 " @ 4c	1 00	
		10 00
Sheet lead, 15 lbs. @ 5½c	82	
" zinc, 15 " @ 5½c	82	
		1 64
Labor, cabinet and mill	3 00	
" carpenter	1 50	
" painters and material	1 00	
		5 50

TANK.

Galvanized iron, No. 18, 70 lbs. @ 5c	3 50	
Solder, 4 " @ 14c	56	
Rivets, tinned, No. 4, ¼ M @ 36c	09	
		4 15
Water tank valve	2 00	
" " spider	05	
Brass spud, 1½ inch	72	
Galvanized union, 1½ inch	20	
		2 97
Labor, tinners		6 00
		62 26
Add 10 per cent		6 22
		$68 48

COST OF INSIDE FINISH—CONTINUED.

ONE HOUSE CLOSET, COMPLETE.

Wolf porcelain hopper			$11 00
Galvanized iron, No. 18,	33 lbs. @ 5 c.	$1 65	
Solder,	2 " @ 14 c.	28	
Lead pipe, ⅝-inch,	35 " @ 5½c.	1 92	
Brass spud, 1¼-inch		72	
			4 57
Lumber, mahogany, 50 feet @ 18c.			9 00
Labor, cabinet and mill		5 80	
" carpenter		2 50	
" painters and material		1 75	
" tinners		4 25	
			14 30
			38 87
Add 10 per cent			3 88
			42 75

ONE WATER COOLER.

Galvanized iron, No. 18,	22 lbs. @ 5c.	1 10	
Solder,	½ " @ 14c.	07	
Rivets, tinned, No. 4,	⅙ M @ 36c.	06	
			1 23
Water cooler faucet		1 27	
" " valve		1 12	
" " ears		03	
			2 42
Labor, tinners		1 60	
" painters and material		1 25	
			2 85
			6 50
Add 10 per cent			65
			$ 7 15

COST OF INSIDE FINISH—CONTINUED.

ONE LADIES' SALOON, COMPLETE.

Lumber, mahogany, 135 feet @ 18c	$24 30	
" white pine, 25 " @ 4c	1 00	
		$25 30
Labor, cabinet and mill	20 00	
" painters and material	5 50	
		25 50
1 door latch, bronze	4 50	
3 " butts, "	1 75	
2 top glass	1 00	
1 porcelain hopper	5 00	
1 hopper top and front, mahogany	3 00	
1 paper box	50	
		15 75
1 marble top washstand, complete		64 52
1 mirror and frame, complete		6 50
		137 57
Add 10 per cent		13 75
		$151 32

Oak finish would cost $130.00.

ONE SET (34) DECK SASH, COMPLETE.

Lumber, mahogany, 62 feet @ 18c		$11 16
Glass, 136 lights @ 7c, 6 inches x 7 inches glass	9 52	
Trimmings, Hart's ratchets	10 20	
Varnish	1 00	
		20 72
Labor cabinet and mill	3 50	
" painters	2 50	
		6 00
		37 88
Add 10 per cent		3 78
		$ 41 66

Deck sash, each, complete, $1.25.

COST OF INSIDE FINISH—CONTINUED.

One Set (34) Double Sash, Complete.

BOTTOM SASH.

Lumber, mahogany, 90 feet @ 18c		$16 20
Glass, 24 inches x 24 inches, 34 lights @ 44c	$14 96	
Trimmings, bronze	15 82	
Varnish	2 50	
		33 28
Labor, cabinet and mill	3 75	
" painters	5 00	
		8 75
		58 23
Add 10 per cent		5 82
		64 05
Bottom sash, each, complete, mahogany	1 90	
" " " " cherry	1 60	

TOP SASH.

Lumber, mahogany, 50 feet @ 18c		9 00
Glass, 10 inches x 24 inches, 34 lights @ 15c	5 10	
Varnish	2 00	
		7 10
Labor, cabinet and mill	3 04	
" painters	2 50	
		5 54
		21 64
Add 10 per cent		2 16
		$23 80
Top sash, each, complete, mahogany	70	
" " " cherry	50	
Sash, per window, complete, mahogany	2 60	
" " " cherry	2 10	

COST OF INSIDE FINISH—CONTINUED.

One Set (34) Double Blinds, Complete.

Lumber, basswood, 350 feet @ 2½c		$ 8 75
Trimmings, bronze	$ 8 00	
Varnish	3 20	
		11 20
Labor, cabinet and mill	6 80	
" painters	7 00	
		13 80
		33 75
Add 10 per cent		3 37
		37 12
Double blinds, per window, complete	1 10	

One set (34) sash curtains.

Curtain fixtures	34 00	
Tin rollers, 1 inch	6 80	
		40 80
Curtain material	36 50	
" trimmings	14 50	
		51 00
Labor, upholsterers		14 20
		106 00
Add 10 per cent		10 60
		$116 60
Curtains, each, complete, per window	$3 43	

COST OF INSIDE FINISH—CONTINUED.

One First-Class Coach Seat, Cushion and Back.

CUSHION.

Maroon plush,	1¾ yards	@	$1.93	$3 38	
Duck, 8 oz.	½ "	@	.19	10	
Burlaps,	⅝ "	@	.05½	04	
Sheeting,	¾ "	@	.12	09	
Grey Hair	1¼ lbs.	@	.35	44	
Tow,	4 "	@	.01½	06	
Twine,	2 ounces	@	.48	06	
Tacks, 4 oz.	4 "	@	.28	07	
Seat springs, H. & K., 17⅝ inches x 21 inches, 6				1 26	
					$5 50
Labor, upholsterers					60
					6 10
Add 10 per cent					61
					6 71

SEAT BACK.

Maroon plush,	1¾ yards	@	$1.93	3 38	
Old gold "	1¾ "	@	1.93	3 38	
Duck, 8 oz.	⅜ "	@	.19	13	
Burlaps,	¾ "	@	.05½	04	
Sheeting,	⅞ "	@	.12	11	
Grey hair,	3½ lbs.	@	.35	1 23	
Tow,	¾ "	@	.01½	01	
Cotton batting,	1 roll			11	
Twine,	1 ounce			03	
Tacks,	2½ "			07	
Springs and slats, H. & K.				84	
					9 33
Labor, upholsterers					75
					10 08
Add 10 per cent					1 00
					$11 08

COST OF INSIDE FINISH—CONTINUED.

One First-Class Coach Seat, Cushion and Back.

SEAT FRAME.

Lumber, mahogany, 10 feet @ 16⅔c	$1 62	
" ash, 19 " @ 2⅝c	47	
		$2 09
Seat arms, 1 pair	36	
" pivots, 1 "	12	
" washers 1 "	06	
" locks, 1 "	40	
" lock stops, 1 "	48	
" stands, 1 "	20	
" foot rests, 1 "	24	
		1 86
Labor, cabinet and mill	2 05	
" painters and material	70	
		2 75
		6 70
Add 10 per cent		67
		7 37
One seat frame, complete	7 37	
" " cushion "	6 71	
" " back "	11 08	
		25 16

ONE RATTAN SEAT, CUSHION AND BACK.

Lumber, ash, 11 feet @ 2⅝c		27
Seat arms, 1 pair	36	
" pivots and washers, 1 "	18	
" stops, 1 "	48	
" stand, 1 "	20	
" foot rests, 2 "	24	
		1 46
Cushion, H. & K. rattan	5 60	
Back, " " "	9 50	
		15 10
Labor, cabinet and mill	2 30	
" painters and material	25	
		2 55
		$19 38

COST OF INSIDE FINISH—CONTINUED.

OAK HEAD LINING.

Oak veneers,	676 feet @ 2 c.	$13 52	
" "	676 " @ 1¼c.	8 46	
Whitewood veneers,	872 " @ 1¾c.	15 27	
Mouldings,	70 " @ 4 c.	2 80	
			$40 05
Glue			7 20
Paint material			4 00
Labor, cabinet, 5c per square foot, 470 feet		23 50	
" painters		15 00	
" ornamenting, $50.00 to $100.00		75 00	
			113 50
			164 75
Add 10 per cent			16 47
			181 22
Oak head lining, ready to ornament, 22c per square foot		103 40	
Putting up head lining, complete		8 00	

TRIMMERS' LABOR INSIDE OF COACH.

Stripping one set of sash	2 hours	50	
" " " blinds	3 "	75	
" " " seats	5 "	1 25	
" body of car	22 "	5 50	
			8 00
Trimming one set of sash and blinds	6 hours	1 50	
" " " seats	8 "	2 00	
			3 50
Putting in one set of sash and blinds	8 hours	2 00	
" " " " seats	12 "	3 00	
			5 00
Trimming car, complete, sash, blinds and seats			$10 00

PAINTERS' LABOR, INSIDE OF COACH.

52 FOOT CAR, 34 DOUBLE SASH.

Washing one set of sash	4	hours	$ 0 60
" " " blinds	4	"	60
" " " seat frames	4	"	60
" head lining	4	"	60
" inside finish of car	8	"	1 20
Filling one set of sash	3	hours	75
" " " seat frames	10	"	2 50
" inside finish of car	17	"	4 25
Sand papering one set of sash	2	hours	50
" " " " seat frames	3	"	75
" " inside finish of car	10	"	2 50
Varnishing one set of sash, 3 coats	4	hours	1 00
" " " blinds, 3 "	10	"	2 50
" " " seat frames, 3 "	4	"	1 00
" head lining, 1 "	4	"	1 00
" inside finish of car, 3 "	58	"	14 50
Rubbing varnish on one set of sash	4	hours	1 00
" " " " " blinds	15	"	3 75
" " " " " seat frames	10	"	2 50
" " " head lining	20	"	5 00
" " " inside finish of car	26	"	6 50

CARPENTER WORK.

Scraping one set of sash and seat frames	40	hours	$10 00
" inside finish of car	80	"	20 00
Sand papering work, complete	20	"	5 00

SCRAPING AND VARNISHING INSIDE OF COACH.

Sash, Blinds and Seats and Washing and Varnishing Head Lining.

MATERIAL.

Sand paper	6 quires	$ 1 00	
Cornstarch filler	10 lbs.	1 00	
Varnish	12 gals.	36 00	
			$38 00

LABOR.

Stripping car inside	32 hours	8 00	
Scraping " "	80 "	20 00	
" sash and seat frames	40 "	10 00	
Sand papering work, complete	20 "	5 00	
			43 00
Filling work, complete	30 hours	7 50	
Varnishing work, complete, 3 coats	76 "	19 00	
			26 50
Washing head lining	4 hours	60	
Varnishing head lining, 1 coat	4 "	1 00	
			1 60
Rubbing varnish	75 hours		18 75
Trimming car inside, complete	40 hours		10 00
			137 85
Add 10 per cent			13 78
			151 63

WASHING AND VARNISHING CAR, COMPLETE.

Material inside, complete	24 50	
Labor " "	34 10	
		58 60
Material outside, complete	19 25	
Labor " "	12 45	
		31 70
		90 30
Add 10 per cent		9 03
		$99 33

PAINTING COACH OUTSIDE, COMPLETE.

Lead and Rough Stuff System.

MATERIAL.

Priming, lead color	40	lbs.	$ 3 20	
Putty	5	"	45	
Rough stuff	6	gals.	7 50	
Stain coat	1	"	1 00	
Body color	10	lbs.	2 50	
Drop black	2	"	50	
Gold leaf	32	books	11 20	
Turpentine	1	gal.	40	
Raw oil	2	"	1 20	
Varnish	6	"	24 00	
Roof color	1½	"	1 00	
Truck and platform color	2	"	2 50	
Sand paper	2	quires	32	
Pumice stone	6	lbs.	36	
				$56 13

LABOR.

Priming, 2 coats	10	hours	$2 50	
Puttying	15	"	3 75	
Rough stuff, 3 coats	15	"	3 75	
Stain coat	3	"	75	
Rubbing surfacer	100	"	15 00	
Body color, 2 coats	12	"	3 00	
Lettering and striping	45	"	13 50	
Varnishing, 3 coats	26	"	6 50	
Painting deck and screens	4	"	80	
" trucks and platforms	6	"	1 20	
" roof	3	"	60	
				51 35
				107 48
Add 10 per cent				10 74
				$118 22

25⅝c per square foot.

PAINTING COACH OUTSIDE, COMPLETE.

SHERWIN & WILLIAMS' 10-DAY SYSTEM.

MATERIAL.

Priming, T and D	3	gals.	$11 28	
Putty	5	lbs.	45	
Surfacer S	1½	gals.	5 64	
Body color	10	lbs.	2 50	
Drop black	2	"	50	
Gold leaf	32	books	11 20	
Turpentine	1	gal.	40	
Raw oil	2	"	1 20	
Varnish	6	"	24 00	
Roof color	1½	"	1 00	
Truck and platform color	2	"	2 50	
Sand paper	6	quires	1 00	
				$61 67

LABOR.

Priming, T and D coats	10	hours	$2 50	
Puttying	15	"	3 75	
Surfacer S, 1 coat	5	"	1 25	
Sandpapering surface	64	"	9 60	
Body color, 2 coats	12	"	3 00	
Lettering and striping	45	"	13 50	
Varnishing, 3 coats	26	"	6 50	
Painting deck and screens	4	"	80	
" trucks and platforms	6	"	1 20	
" roof	3	"	60	
				42 70
				104 37
Add 10 per cent				10 43
				$114 80

21⅝c per square foot.

PAINTING COACH OUTSIDE, COMPLETE.

Lead and Scraping Filler System.

MATERIAL.

Priming, lead color	40	lbs.	$ 3 20	
Putty	5		45	
Scraping filler	½	gal.	75	
Body color	10	lbs.	2 50	
Drop black	2	"	50	
Gold leaf	32	books	11 20	
Turpentine	1	gal.	40	
Raw oil	2	"	1 20	
Varnish	6	"	24 00	
Roof color	1½	"	1 00	
Truck and platform color	2	"	2 50	
Sand paper	4	quires	64	
				$48 34

LABOR.

Priming, 2 coats	10	hours	$2 50	
Puttying	15	"	3 75	
Surface color, 1 coat	5	"	1 25	
Sandpapering	10	"	1 50	
Scraping filler	24	"	6 00	
Sandpapering filler	30	"	4 50	
Body color, 2 coats	12	"	3 00	
Lettering and striping	45	"	13 50	
Varnishing, 3 coats	26	"	6 50	
Painting deck and screens	4	"	80	
" trucks and platforms	6	"	1 20	
" roof	3	"	.60	
				45 10
				93 44
Add 10 per cent				9 34
				$102 78

19⅝c per square foot.

PAINTING COACH OUTSIDE, COMPLETE.

Washing Outside and Painting Over Old Paint.

MATERIAL.

Soft soap	1 pail	$ 0 25	
Pumice stone	8 lbs.	40	
White lead	20 "	1 60	
Putty	5 "	45	
Body color	10 "	2 50	
Drop black	2 "	50	
Gold leaf	32 books	11 20	
Turpentine	1 gal.	40	
Raw oil	2 "	1 20	
Varnish	6 "	24 00	
Roof color	1½ "	1 00	
Sand paper	4 quires	64	
Truck and platform color	2 gals.	2 50	
			$46 64

LABOR.

Washing car	40 hours	6 00	
Sandpapering	20 "	3 00	
Lead color, 1 coat	5 "	1 25	
Puttying	15 "	3 75	
Sandpapering	20 "	3 00	
Body color, 2 coats	10 "	2 50	
Lettering and striping	45 "	13 50	
Varnishing, 3 coats	26 "	6 50	
Painting deck and screens	4 "	80	
" trucks and platforms	6 "	1 20	
" roof	3 "	60	
			42 10
			88 74
Add 10 per cent			8 87
			$97 61

18¼c per square foot.

COMPARATIVE COST OF

DIFFERENT SYSTEMS OF PAINTING COACHES, OUTSIDE.

MURPHY'S A B C SYSTEM.

Material required, complete	$62 30	
Labor " "	51 35	
		$113 65
Add 10 per cent		11 36
23 7c per square foot.		125 01

LEAD AND ROUGH STUFF SYSTEM.

Material required, complete	56 13	
Labor " "	51 35	
		107 48
Add 10 per cent		10 74
22 5c per square foot.		118 22

SHERWIN & WILLIAMS' 10-DAY SYSTEM.

Material required, complete	61 67	
Labor " "	42 70	
		104 37
Add 10 per cent		10 43
21 8c per square foot.		114 80

LEAD AND SCRAPING FILLER SYSTEM.

Material required, complete	48 34	
Labor " "	45 10	
		93 44
Add 10 per cent		9 34
19 5c per square foot.		102 78

PAINTING OVER OLD PAINT.

Material required, complete	46 64	
Labor " "	42 10	
		88 74
Add 10 per cent		8 87
18 1c per square foot.		97 61

NOTE.—For burning off old paint, 65 hours	13 00	
Sandpapering, ready to paint, 35 hours	8 75	
Add to above prices		$21 75

CAR HEATING.

HOT WATER SYSTEM.

One of the greatest improvements in car heating over the old system of direct radiation from wood or coal stoves, was the introduction of hot water heaters, such as the Baker, Searles, Johnson, etc., all depending on the same original principle, the circulation of hot water through a closed system of circulating pipes.

The circulation of the water in these pipes is caused by the difference in the weight of the water in the up and down pipes from the drum, due partially to the difference of temperature, and principally to the fact that steam bubbles form in the coil and the up pipe from the heater, thus displacing about one-half the volume of water in this pipe.

If the fire in the heater is forced to a point where steam is generated in the drum, sufficient to exert a pressure, the circulation in the pipes is retarded or wholly stopped, until this pressure is removed, as the pressure in the drum acts equally on both the up and down pipes until an equilibrium is established, after which an explosion is liable to occur.

Where a car requires over five hundred feet of circulating pipe, a multiple system should be applied, as the weight of water in the down pipe is not sufficient to overcome the friction in the circulating pipes and fittings.

CAR HEATING—CONTINUED.

HOT WATER SYSTEM.

In this case two coils are placed in the heater and two drums and sets of pipe used, each side of the car being independent; in another system a special fitting is placed below the drum, from which two or four down pipes lead to the different parts of the car, and the return pipes all leading to a special fitting below the coil.

STEAM HEATING.

All of the different systems of indirect steam heating depend on the hot water pipes to distribute the heat. In these systems a drum is placed at some point where the water in the circulating pipes passes through it, causing the water to become heated and circulate the same as in the hot water system.

In the direct system of steam heating a line of pipe is placed alongside of the car, with branches under the seats, and direct steam admitted from the train pipe; this is the simplest and most satisfactory system, as well as the cheapest, for general service.

Average steam heaters, whether direct or indirect, condense about 64 pounds of water per car per hour.

Average amount of water evaporated per pound of coal, 8 pounds.

CAR HEATING—CONTINUED.

WROUGHT IRON PIPE.

Diameter.		External Circumferences.	Length of Pipe.		Nominal Weight per Foot.
Internal.	External.		Per Sq. Foot of Surface.	Containing 1 Cubic Foot.	
Inches.	Inches.	Inches.	Feet.	Feet.	Pounds.
1	1.315	4.131	2.904	166.9	1.668
1¼	1.66	5.215	2.301	96.25	2.244
1½	1.9	5.969	2.01	70.66	2.678
2	2.375	7.461	1.608	42.91	3.609

Temperature of steam under pressure:

1 pound pressure = 212° 40 pounds pressure = 287°
10 " " = 239° 60 " " = 307°

Weight of one foot of water in 1¼ inch pipe:

32° = .6470 pounds. 250° = .6102 pounds.
200° = .6230 " 300° = .5974 "

By making bends in water pipes five times the diameter of pipe, it reduces the friction to 0.

Reaming the inside ends of pipes, at joints, reduces the friction 33 per cent.

Figure one square foot of heating surface to 25 cubic feet of space for car heating.

Water is the best medium to store heat, where steam = 1, iron pipe = 86, water = 231.

Expansion of air is directly proportional to the difference in temperature.

459° below zero is estimated as absolute basis.

CAR HEATING—CONTINUED.

COST OF BAKER HEATER.

Castings, 275 pounds	$5 50	
Casings, inside	3 00	
" outside	3 75	
Smoke top	1 85	
Hood	95	
Expansion drum	6 50	
Coil	5 00	
Pipes to drum	1 40	
Safety valve	1 40	
Combination cock	1 90	
Drum stands and cover	50	
		$31 75
Labor fitting up stove		4 00
Heater pipe and fittings, 350 feet, 1¼ inches	55 25	
Labor piping car	20 00	
		75 25
		111 00

STEAM HEATING EQUIPMENT.

Train pipe and fittings, 60 feet, 1½ inches	12 00	
" " covering, asbestos	13 00	
Steam hose and coupling	8 00	
		33 00
Labor on train pipe		4 50
		37 50
Steam heating equipment, indirect system, without piping, costs per car		125 00

PINTSCH LIGHT EQUIPMENT.

Consisting of 1 receiver, 1 regulator, stop cocks and piping for car complete	155 00	
4 center lamps, No. 196, $30.00	120 00	
1 receiver (extra)	75 00	
		$350 00
1 regulator, No. 244	$45 00	
Average cost of Pintsch light per car per hour		05

REPAIRS TO TRUCKS.

REMOVING OLD AND APPLYING NEW MATERIAL.

	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
1 wheel piece	40 feet.	$ 1 00	$ 2 50	$ 3 50
2 " "	80 "	2 00	5 00	7 00
1 end sill	22 "	55	1 25	1 80
2 " "	44 "	1 10	2 50	3 60
1 cross timber	31 "	75	2 25	3 00
2 " "	62 "	1 50	3 00	4 50
1 bolster	80 "	2 00	1 25	3 25
1 spring plank	42 "	1 05	1 50	2 55
Renewing all timbers, one 4-wheel truck	392 "	9 80	10 00	19 80
" " " " 6 " "	510 "	12 75	17 25	30 00
1 center plate	62 lbs.	1 00	25	1 25
1 side bearing	18 "	30	10	40
1 pedestal	160 "	2 50	50	3 00
1 oil box	90 "	2 50	25	2 75
1 brake shoe	20 "	30		30
1 bolster hanger	18 "	70	25	95
1 " " top pin	3 "	10	10	20
1 " " bottom pin	39 "	1 10	50	1 60
Renewing 4 hangers and pins, credit scrap	162 "	4 20	2 50	6 70
Repairing 4 hangers, plugging holes, new pins.	84 "	2 00	4 00	6 00
Above prices do not include jacking up car.				
Changing one pair of wheels, labor				2 00
" " " and turning tires.				7 00
Estimate wear on steel tires $2.00 per $\frac{1}{16}$ inch...				

STANDARD BRAKE RIGGING.

PASSENGER EQUIPMENT WITH 10-INCH CYLINDERS AND 4-WHEEL TRUCKS.

2 cylinder levers,	1 inch x 4 inches	53 lbs.	
2 floating "	1 " x 3½ "	58 "	
2 lever guides	½ " x 1½ "	23 "	
2 carry irons and links,	⅝ " x 2½ "	25 "	
1 cylinder rod	1 "	21 "	
6 main rods,	¾ "	188 "	
2 stops for rods,	¾ " x 4 inches	17 "	
2 hangers for rods,	¾ "	2 "	
9 " for air pipe,	¼ " x 1½ inches	20 "	
14 connection pins,	1⅛ "	17 "	
2 live levers,	1 inch x 4 inches	60 "	
2 dead "	1 " x 4 "	60 "	
2 " " guides,	⅝ " x 2½ "	55 "	
2 live " "	⅜ " x 2 "	32 "	
2 bottom rods,	1 "	82 "	
10 connection pins,	1⅛ "	12 "	
8 brake hangers,	⅞ inch	40 "	
8 " safety hangers,	¼ " x 2 inches	52 "	
8 " springs,	⅜ " x 3 "	84 "	
4 " balance springs,	⅜ " x 3 "	20 "	
8 " shoe keys,	⅛ " x 1 "	10 "	
8 brake hanger castings		44 "	
8 " shoes		160 "	
4 dead lever brackets		20 "	
4 " " guide washers		10 "	
4 brake beams, National hollow			$17 00

STANDARD BRAKE RIGGING.

PASSENGER EQUIPMENT WITH 14-INCH CYLINDERS AND 6-WHEEL TRUCKS.

2 cylinder levers,	1 inch x 6½ inches x 3 feet 5 inches	93 lbs.	
2 floating "	1 " x 4½ " x 3 " 11 "	82 "	
2 intermediate levers,	1 " x 4½ " x 2 " 9 "	61 "	
4 lever fulcrums,	⅞ " x 6 " x 3 " 6 "	379 "	
2 lever guides	½ " x 2 "	107 "	
1 cylinder connection,	1¼ " x 3 feet 5 inches	29 "	
4 floating lever "	1⅛ " x 1 " 11 "	35 "	
6 main rods,	⅞ "	214 "	
22 connection pins,	1⅛ "	28 "	
2 live levers,	1 inch x 6 inches	79 "	
2 balance levers,	1 " x 4½ inches	17 "	
2 crescent fulcrums,	1 " x 4 "	138 "	
4 bottom connections,	1⅛ "	85 "	
28 connection pins,	1⅛ "	37 "	
12 brake hangers,	1 inch	74 "	
12 " " bolts,	1 "	25 "	
4 " beam hangers,	⅝ " x 3 inches	39 "	
12 " " safety hangers,	¼ " x 3 "	139 "	
6 " " fulcrums,	¾ " x 2½ "	100 "	
4 " " safety straps,	1 "	16 "	
18 " springs,	⅜ " x 3 inches	120 "	
4 " balance spring stays,	1 "	16 "	
8 " shoe keys,	⅛ " x 1 inch	10 "	
8 brake hanger castings		130 "	
12 " shoes		300 "	
6 brake beams, National hollow			$25 50

WESTINGHOUSE PASSENGER CAR BRAKE EQUIPMENT.

REPAIR PRICES FOR STANDARD 10-INCH CYLINDER, SCHEDULE C 1.

Equipment for car complete, schedule C 1		$100 00
10-inch cylinder and triple valve, complete,	plate F 28, No. 1	16 50
Cylinder body,	" " 28, " 2	4 75
Piston head and rod,	" " 28, " 3	2 15
Back head,	" " 28, " 4	1 75
Front "	" " 28, " 5	3 00
Cross "	" " 28, " 6	35
Packing leather,	" " 28, " 9	80
Release spring,	" " 28, " 12	1 00
Reservoir, 12 inches x 33 inches,	plate F 23, No. 4	8 00
Triple valve, complete,	plate F 27, No. 1	15 00
" " body,	" " 27, " 2	5 50
Slide valve for triple valve,	" " 27, " 3	1 00
Piston " " "	" " 27, " 4	2 00
Drain cup " " "	" " 27, " 19	75
Hose and coupling complete, 1 inch, each,	plate F 32, No. 1	2 12
Coupling for 1 inch hose, "	" " 32, " 2	75
Hose, standard 1 inch, "	" " 32, " 3	1 00
Angle cock, 1 inch x 1¼ inches, "	" " 32, " 7	2 00
" " body,	" " 32, " 7	1 10
" " key,	" " 32, " 7	50
Cutout cock,	plate F 32, No. 8	1 50
Conductor's valve,	" " 32, " 9	2 25
Reservoir drain cup,	" " 32, " 10	1 25
Air signal complete, schedule K		10 00

WESTINGHOUSE PASSENGER CAR BRAKE EQUIPMENT.

Repair Prices for Standard 12-Inch and 14-Inch Cylinders.

STANDARD 12-INCH CYLINDER.

Equipment for car complete, schedule R		$110 00
12-inch cylinder and triple valve, complete,	plate F 30, No. 1	22 00
Cylinder body,	" " 30, " 2	8 00
Piston and rod,	" " 30, " 3	3 50
Back head,	" " 30, " 4	2 00
Front "	" " 30, " 5	4 00
Cross "	" " 30, " 6	50
Packing leather,	" " 30, " 9	1 00
Release spring,	" " 30, " 12	1 25
Reservoir, 14 inches x 33 inches,	plate F 23, No. 3	10 50

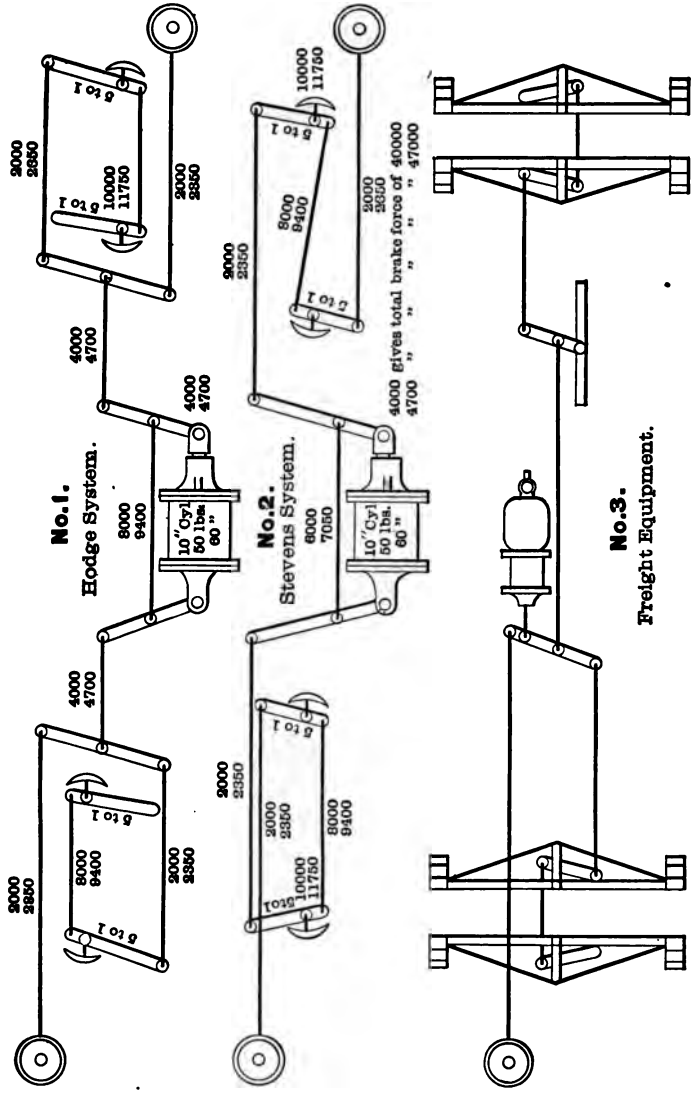
STANDARD 14-INCH CYLINDER.

Equipment for car complete, schedule P		120 00
14-inch cylinder and triple valve, complete,	plate F 31, No. 1	28 00
Cylinder body,	" " 31, " 2	8 50
Piston and rod,	" " 31, " 3	3 65
Back head,	" " 31, " 4	3 00
Front "	" " 31, " 5	4 00
Cross "	" " 31, " 6	50
Packing leather,	" " 31, " 9	2 00
Release spring,	" " 31, " 12	2 50
Reservoir, 16 inches x 33 inches,	plate F 23, No. 2	13 00

Triple valve, hose, cocks, etc., for 12-inch x 14-inch cylinders same prices as given for 10-inch cylinder.

CAR BRAKE LEVERS.

FROM "WESTINGHOUSE" INSTRUCTION BOOK.



CAR BRAKE LEVERS—CONTINUED.

WESTINGHOUSE.

The Hodge and Stevens systems of car brake levers are shown in Figs. 1 and 2, page 42. The Stevens differs from the Hodge in that the floating or Hodge lever (which is interposed between the cylinder levers and the truck lever in the Hodge system) is omitted and the outer end of the cylinder lever is extended sufficiently to couple directly with the truck lever, the added length of the cylinder lever reducing the force transmitted, so that the effect at the brake shoe is precisely the same as in the Hodge system. Both systems are employed for passenger car brake gear, the preference for either being much a matter of personal choice. While the Stevens system is somewhat simpler than the Hodge, the latter, as usually applied to passenger cars, admits of a better hand brake gear than the former, and, for this reason, is generally preferred for this service.

Special provision for the use of the Stevens system is made in the construction of the automatic freight car brake apparatus as shown in Fig. 3, page 42 by which an equally efficient hand gear is had as with the Hodge system.

The peculiar construction of the various classes of railway vehicles often necessitates modifications of either system in the application of the brake gear.

CAR BRAKE LEVERS—CONTINUED.

WESTINGHOUSE.

The relative forces existing in the Quick Action Automatic Brake when applied for a "service" or "emergency" stop are shown in Figs. 1 and 2 with the *given* proportion of levers, resulting from 70 pounds pressure of air in the train pipe and auxiliary reservoirs, rating the air pressure upon the piston at 50 pounds per square inch in a "service" and 60 pounds in an "emergency" application of the brakes. The lesser figures also show the total effect at the brake shoes, when using the old style triple valves with levers of the same proportion.

When either system of brake gear is applied to a car, having decided upon the proportions of the truck levers best suited to the car truck, and the total length of the cylinder levers, the following rules may be used in calculating the required proportions of the cylinder lever.

To find the total power required:

Subtract 10 per cent. of the weight of the car *at the track under the wheels*, to which brakes are to be applied, for passenger cars, and 30 per cent. for freight cars.

To find the leverage required:

Divide the total brake power required by the *whole* pressure on the piston.

To find the proportion of the brake beam levers:

Divide the *whole* length of the lever by the short end.

CAR BRAKE LEVERS—CONTINUED.

WESTINGHOUSE.

To find the total brake beam leverage:

Multiply the proportion of the brake beam lever by two (2) for the *Hodge* system and by four (4) for the *Stevens.*

To find the proportion of cylinder lever:

Multiply the *whole* length of the lever by either the *required* leverage or the total brake beam leverage, and divide by the sum of both; the result will give the length of one end of the lever.

If the required leverage is greater than the *total* brake beam leverage, the long end of the lever must go next to the cylinder, if less, the short end must go next to the cylinder.

Dead levers must be made in the same proportion as the live truck levers.

EXAMPLE—HODGE SYSTEM.

Weight of car	40,000 lbs.
" " " less 10 per cent	36,000 "
Total pressure on 10-inch cylinder, emergency	4,700 "
Total length of brake beam levers	28 inches.
Length of short end of brake beam lever	7 "
Total length of cylinder lever	24 "

36000 ÷ 4700 = 7.66, leverage required.
28 ÷ 7 = 4 × 2 = 8, total brake beam leverage.
24 × 7.66 = 183.84 ÷ (8 + 7.66) = 11.74, short end of cylinder lever.
24 — 11.75 = 12.26, long end of cylinder lever.

EXAMPLE—STEVENS SYSTEM.

Total length of cylinder lever, 36 inches.
36000 ÷ 4700 = 7.66, leverage required.
28 ÷ 7 = 4 × 4 = 16, total brake beam leverage.
36 × 7.66 = 275.76 ÷ (7.66 + 16) = 11.66, short end of cylinder lever.
36 — 11.66 = 24.34, long end of cylinder lever.

STANDARD COACH.

Detail Bill of Material in Body.

DIMENSIONS.

Length over end sills, 52 feet 5 inches.
Width over side sills, 9 feet 8 inches.
Westinghouse air brakes.
Steam heat.
Frost lights.
Miller platforms.
4-wheel trucks, 36-inch steel wheels.

LUMBER.

2 side sills, yellow pine,	5 in. x 8 in. x 52 ft. 5 in.	444 feet.	
2 center sills, yellow pine,	4 in. x 8 in. x 51 ft. 9 in.	367 "	
2 inter. " " "	4 in. x 8 in. x 51 ft. 9 in.	367 "	
2 truss plank, " "	2⅛ in. x 10¼ in. x 52 ft.....	285 "	
2 side plates, " "	2½ in. x 4 in. x 52 ft. 8 in.	119 "	
2 deck sills, " "	2¼ in. x 5⅛ in. x 54 ft. 5 in.	139 "	
2 " plates, " "	2¼ in. x 3 in. x 53 ft.....	87 "	
2 belt rails, " "	2½ in. x 5 in. x 55 ft. 6 in.	163 "	
			1971 feet.
2 end plates, yellow pine,	3¼ in. x 16½ in. x 10 ft.....	112 "	
4 side braces, " "	1¼ in. x 8 in. x 15 ft. 4 in.	84 "	
2 " " " "	1¼ in. x 4 in. x 10 ft.....	13 "	
12 side braces, counter, yellow pine, 1¼ inches x 6 inches....		73 "	
100 studding, yellow pine, 1½ inches x 4 inches x 6 feet 11 in.		459 "	
Bridging, blocking, etc.....		475 "	
			1216 "
Flooring, top, quarter sawed, ⅞ inch x 2¼ inches.....		649 "	
			649 "
Flooring, bottom, plain	⅞ inch x 2¼ inches.....	690 "	
			690 "

STANDARD COACH.

Detail Bill of Material in Body.

LUMBER—CONTINUED.

2 end sills, oak, 6¾ inches x 8 inches x 9 feet 2½ inches.....	109 feet.	
2 cross ties, " 4¼ " x 7¼ " x 9 " 8 "	67 "	
		176 feet.
1 platform end sill, oak, 7 in. x 8 in. x 8 ft. 6 in....	45 feet.	
4 " center timbers, oak, 4 in. x 12 in. x 14 ft.....	264 "	
4 " inter. " " 4 in. x 12 in. x 14 ft.....	264 "	
4 " step " " 2½ in. x 10 in. x 3 ft.....	28 "	
2 " truss blocks, " 6 in. x 6 in. x 4 ft.....	32 "	
2 " " " " 6 in. x 6¼ in. x 1 ft. 2 in...	10 "	
2 " buffer " " 6½ in. x 8¼ in. x 1 ft.....	11 "	
2 " " " " 2½ in. x 6¼ in. x 1 ft. 2½ in..	5 "	
Blocking, oak	30 "	
		689 "
Letter boards and eave mouldings, poplar.....	460 feet.	
Corner and door posts, poplar.....	196 "	
Side and end siding and mouldings, poplar.....	730 "	
Deck frame and finish, poplar.....	1326 "	
Hoods " " " "	409 "	
Deafening floor, poplar.....	1261 "	
		4382 "
Roofing, upper and lower deck, white pine		1233 "
Inside finish, complete, mahogany.....		1960 "

VENEERS.

Whitewood, head lining.....	872 "
White oak, " "	1352 feet.

STANDARD COACH.

Detail Bill of Material in Body.

FORGINGS.

2 body bolsters	1 inch x 8 inches	1013 lbs.
4 " truss rods,	$1\frac{1}{4}$ "	308 "
4 " " " anchors,	$\frac{3}{4}$ " x 3 inches	142 "
4 " " " " bolts,	$1\frac{1}{4}$ "	8 "
2 " " " inside	$\frac{3}{8}$ " x $1\frac{3}{4}$ inches	217 "
4 " " " ends,	$\frac{7}{8}$ "	33 "
4 " " " studs,	$1\frac{1}{2}$ " $\frac{7}{8}$ inch brace	46 "
4 angle irons for steps,	$\frac{5}{16}$ inch x $2\frac{1}{2}$ inches	21 "
8 " " " platforms,	$\frac{3}{8}$ " x $1\frac{1}{2}$ "	9 "
4 " " " truss plank,	$\frac{1}{2}$ " x $1\frac{1}{2}$ "	9 "
4 " " " saloon,	$\frac{1}{4}$ " x $1\frac{1}{2}$ "	2 "
8 carlines,	$\frac{5}{8}$ inch x $1\frac{1}{2}$ inches	328 "
4 " extra,	$\frac{1}{2}$ " x 2 "	38 "
4 plates on cross ties,	$\frac{3}{8}$ inch x 4 inches	11 "
2 air drum bands	$\frac{3}{8}$ " x $1\frac{1}{2}$ "	11 "
2 king bolts,	$1\frac{3}{4}$ "	40 "
4 body hand rails,	$\frac{5}{8}$ "	28 "
2 brake chains,	$\frac{3}{8}$ " x 3 feet 10 inches	12 "
2 platform rail chains,	$\frac{1}{4}$ "	2 "
4 hose coupling chains,	$\frac{1}{2}$ "	3 "
8 air pipe hangers,	$\frac{1}{4}$ inch x $1\frac{1}{2}$ inches	4 "
4 steam pipe hangers,	$\frac{3}{8}$ " x 2 "	15 "
3 frost light bands,	$\frac{3}{8}$ " x $1\frac{3}{4}$ "	15 "
Body rods		482 "
Body bolts		297 "
Amount carried forward		3094 lbs.

STANDARD COACH.

Detail Bill of Material in Body.

FORGINGS—CONTINUED.

Amount brought forward			3094 lbs.
2 Miller carry irons, front,	$\frac{3}{4}$ inch x 4 inches		43 "
2 " " " back,	$\frac{1}{2}$ " x 3 "		26 "
4 " followers,	$1\frac{1}{2}$ " x 6 "		70 "
2 " tail pins,	$1\frac{3}{4}$ "		30 "
4 " spring pockets,	$\frac{7}{8}$ " x 4 inches		240 "
2 " uncoupling levers			50 "
2 " " " guides,	$\frac{3}{8}$ inch x 1 inch		4 "
2 " " " chains,	$\frac{3}{8}$ "		10 "
2 " boot braces,	$\frac{7}{8}$ "		11 "
2 " buffers			64 "
2 " followers,	$\frac{3}{4}$ inch x 6 inches		17 "
2 " face plates,	$\frac{3}{8}$ " x 7 "		32 "
8 platform pillars,	$1\frac{1}{2}$ inches		84 "
4 " hand rails,	$\frac{1}{2}$ " x 2 inches		90 "
2 " brake masts,	$1\frac{1}{4}$ "		55 "
2 " " " steps,	$\frac{5}{8}$ " x $2\frac{1}{2}$ inches		51 "
2 coupling pins and chains,	$1\frac{1}{2}$ inches		30 "
4 safety chains and loops	1 "		72 "
4 nosing bands,	$\frac{1}{8}$ " x 4 inches		7 "
12 hook rods,	$\frac{7}{8}$ inch		273 "
4 " " plates,	$\frac{1}{2}$ " x 5 inches		7 "
Platform bolts			148 "
Amount carried forward			4521 lbs.

STANDARD COACH.

Detail Bill of Material in Body.

TRIMMINGS.

1	bell cord, 80 feet	$ 0 80	
1	" " guide	14	
2	" " bushings	16	
10	" " "	1 45	
1	" " pulley	35	
14	" " straps	1 54	
2	" " couplings	13	
7	" " hangers and sheaves	6 58	
2	" " tubes	16	
			$11 31
3	pair butts, acorn, 3½ inches x 3 inches	3 66	
1½	" " " 3¼ " x 2½ "	1 68	
1	" " hopper cover	46	
3	" " broad	08	
			5 88
1	box brass escutcheon pins	38	
15	basket racks	73 35	
30	brass bushings	15	
1	card of instructions	25	
1	combination hook	70	
			74 83
2	door holders	1 00	
2	" sash catches and plates	45	
2	sash pivots and bushings	25	
			1 70
34	Hart's ratchets	8 50	
34	" pulls	1 70	
4	hooks, iron	02	
			10 22
	Amount carried forward		$103 94

STANDARD COACH.

Detail Bill of Material in Body.

TRIMMINGS—CONTINUED.

Amount brought forward	$103 94	
2 locks R. H. coach	8 00	
1 " L. H.	2 14	
1 latch, combination	4 40	
1 lead pipe	30	
2 O. S. door bolts	52	
2 platform notice plates	90	
1 smoke jack	90	
34 sash locks	6 46	
34 " lifts	3 80	
152 " springs	1 52	
102 " stops	2 04	
1 saloon hopper	5 00	
1 " " chute	26	
1 " urinal	4 10	
1 " " pipe	68	
1 " " drip pan	2 90	
8 tin tubes and flanges	56	
2 transom sash stops	66	
1 ventilator	60	
1 water cooler, complete	7 15	
2 key blanks	30	
2 " escutcheons	15	
		$157 28

STANDARD COACH.

Detail Bill of Material in Body.

GLASS.

34 lights,		24	inches x 24	inches		$14 28	
34	"	10	" x 24	"		4 42	
2	"	20	" x 24	"		68	
2	"	10	" x 20	"		22	
4	"	15	" x 18	"		60	
136	"	deck, 6	" x 7	"	embossed	8 16	
3	"	11½	" x 13½	"		27	
1	"	14	" x 36	"		22	
							$ 28 25

CURTAINS.

34 imperial curtain fixtures,		27½	inches		$34 00	
2	" " "	23½	"		2 00	
36 tin rollers, 1-inch,		27½	"		7 20	
Curtain material, 18 yards					38 70	
Silk binding,	57	"			1 70	
Holland,	3	"			90	
Leather					8 50	
Silk thread					1 00	
Cotton thread					05	
						94 05

FROST LIGHTS.

Equipment complete, 3 lights		315 00

STEAM HEAT.

Equipment complete		125 00

STANDARD COACH.

Detail Bill of Material in Body.

UPHOLSTERY MATERIAL.

Burlaps,	48	yards	@ $0 05¾	$2 76		
Sheeting,	60	"	@ 12	7 20		
Cotton,	25	lbs.	@ 12	3 00		
Grey hair,	150	"	@ 31	46 50		
Tow,	150	"	@ 2½	3 75		
Spring twine,	1½	"	@ 12	18		
Stitching twine,	6	"	@ 24	1 44		
Maroon plush,	86	yards	@ 1 40	134 40		
Old gold "	31	"	@ 1 40	43 40		
Montana duck,	22	"	@ 19	4 18		
Ontario "	20	"	@ 24¾	4 95		
Spiral springs,	60		@ 1	60		
Cotton thread,	2	spools	@ 5	10		
Red linen thread,	3	"	@ 8	24		
						$252 70
27 spring-edge cushion frames and backs				115 00		
27 metal fixtures, complete, H. & K.				142 00		
						257 00

TINNER'S MATERIAL.

Terne tin,	203	lbs.	@ $0 13	26 39	
Solder,	39	"	@ 15	5 11	
Sheet copper,	60	"	@ 19	11 40	
" zinc,	30	"	@ 5½	1 65	
Galvanized iron,	38	"	@ 5½	2 09	
Charcoal "	52	"	@ 4	2 08	
Russia "	10	"	@ 10	1 00	
					$49 72

STANDARD COACH.

Detail Bill of Material in Body.

MISCELLANEOUS.

2 Miller hooks, complete, cast steel	$ 35 00	
2 " " springs, 3 feet 6 inches long	4 50	
2 draw springs, 6 inches x 8 inches, 2 coil	1 50	
2 buffer " 6 " x 8 " 2 "	1 50	
2 turnbuckles, Cleveland, 1½ inch	70	
		$ 43 20
Westinghouse air brake, complete, schedule C	100 00	
" signal, schedule K	10 00	
" pipes and fitting	11 60	
		121 60
Brass wire cloth, 88 feet	8 80	
Weather strips, ½ inch, 275 "	6 87	
" " oak, 78 "	3 13	
		18 80
Wrecking tools, saw, axe and sledge	2 50	
Nuts, 130 lbs	5 25	
Washers, 67 "	2 00	
Lag screws, 110 "	1 10	
Nails, 150 "	7 50	
Screws, 79 gross	33 25	
		51 60
Glue, 140 lbs	22 40	
Sand paper, 38 quires	6 00	
		28 40
Paint material, complete		$110 00

STANDARD COACH.

SUMMARY.

Lumber, yellow pine, long	1971 feet.	
" " " short	2555 "	
" oak	865 "	
" poplar	4382 "	
" white pine	1233 "	
" mahogany	1960 "	
Veneers, white wood	872 "	
" " oak	1352 "	
Forgings	4945 lbs.	
Castings	1115 "	
Trimmings		$157 28
Glass		28 85
Curtains		94 05
Upholstery material		509 70
Air brakes complete		121 60
Steam heat "		125 00
Frost lights "		315 00
Tin material "		49 72
Paint material complete		110 00
Miscellaneous		142 00

LABOR.

Lumber yard and mill.
Car builders and cabinet makers.
Blacksmith and machine shop.
Tinners and steamfitters.
Painters and upholsterers.
Glass work and silver platers.

STANDARD 4-WHEEL TRUCKS.

Detail Bill of Material.

DIMENSIONS.

Center to center of journals, 8 feet.
Steel wheels, 36 inches.
Journals, M. C. B. standard, 3¾ " x 7 inches.
Brasses, " " " " 3¾ " x 7 "
Steel brake beams.
Wheel pieces, plated both sides.
End sills, plated on top.
Bolsters, plated, 2 flitch plates.

LUMBER.

4 wheel pieces,	white oak,	4 inches	x 7 inches	x 12 feet	158 feet.
4 cross "	" "	4½ "	x 9 "	x 6 " 8 inches	123 "
4 end sills,	" "	4¼ "	x 6 "	x 7 feet	88 "
8 safety beams,	" "	3 "	x 10 "	x 5 " 4 inches	165 "
4 bolster pieces,	" "	4¼ "	x 8 "	x 5 " 6 "	90 "
2 " "	" "	7 "	x 8 "	x 5 " 6 "	72 "
4 spring plank,	" "	3 "	x 8⅜ "	x 5 " 8 "	84 "
8 dust guards, elm,		9/16 "	x 6½ "	x 9 inches	5 "
					785 feet.

FORGINGS.

8 wheel piece plates,	⅜ inch	x 7 inches	x 12 feet	818 lbs.
4 end sill plates,	½ "	x 4 "	x 6 " 6½ inches	170 "
8 tie plates, wheel piece,	⅝ "	x 3 "		75 "
4 bolster plates,	¾ "	x 6 "	x 5 feet 6 inches	332 "
4 equalizers,	2 "	x 4½ "	x 8 " ctrs	1044 "
4 pedestal tie bars,	⅝ "	x 3 "		318 "
4 " cross tie bars,	¾ "	½ "	x 2½ inches, ends	54 "
Weight carried forward				2811 lbs.

STANDARD 4-WHEEL TRUCKS.

Detail Bill of Material.

FORGINGS—CONTINUED.

Weight brought forward				2811 lbs.
8 bolster hangers,	$1\frac{1}{4}$ inches	x 4 inches x 10 inches ctrs.		140 "
8 " " U-bolts,	1 "	x 2 feet x $7\frac{1}{2}$ "		53 "
8 " " pins, top,	$1\frac{3}{8}$ "			20 "
4 " " " bottom,	2 "	x 3 inches x 2 inches ends		157 "
8 " " " keys,	$\frac{1}{2}$ "			2 "
4 " safety straps,	$\frac{3}{4}$ "	x $3\frac{1}{2}$ inches		203 "
8 axle " "	$\frac{5}{8}$ "	x $2\frac{1}{2}$ "		90 "
2 live levers,	1 inch	x 4 inches		60 "
2 " " guides,	$\frac{3}{8}$ "	x 2 "	x 4 feet 8 inches.	32 "
2 dead "	1 "	x 4 "		60 "
2 " " guides,	$\frac{5}{8}$ "	x $2\frac{1}{2}$ "	x 5 feet	55 "
4 compression straps,	$\frac{5}{8}$ inch	x 3 inches x 2 feet $1\frac{1}{2}$ inches		54 "
8 washer plates, U-bolts,	$\frac{1}{4}$ "	x $1\frac{3}{4}$ "		3 "
8 cross truss rods,	$\frac{7}{8}$ "	square x 7 feet $\frac{3}{4}$ inch		144 "
8 brake beam safety straps,	$\frac{1}{4}$ inch	x 2 inches		52 "
8 " springs,	$\frac{3}{8}$ "	x 3 "		84 "
4 " balance springs,	$\frac{3}{8}$ "	x 3 "		20 "
8 " hangers,	$\frac{7}{8}$ "			37 "
2 " connection rods,	1 "			82 "
10 " " pins,	$1\frac{1}{8}$ "			12 "
8 check chains,	$\frac{5}{8}$ "	x 2 feet 3 inches		70 "
				4241 lbs.

SUMMARY OF FORGINGS.

Truck forgings	4067 lbs.
" rods and bolts	446 "
" brake springs	104 "
" safety chains	70 "

STANDARD 4-WHEEL TRUCKS.

Detail Bill of Material.

CASTINGS.

8 pedestals	1282 lbs.
8 oil boxes, M. C. B. lids	730 "
2 center plates	125 "
4 side bearings	70 "
4 truss rod saddles	18 "
8 " " washers	23 "
16 bolster chafe plates	110 "
8 spiral spring caps	174 "
8 " " seats	126 "
8 elliptic " "	71 "
8 bolster hanger castings	44 "
8 brake " "	24 "
8 " shoes	144 "
2 dead lever brackets	19 "
4 lever guide washers	10 "
76 cast washers	52 "
	3022 lbs.

MISCELLANEOUS.

8 steel wheels, 36 inches.
4 axles, $3\frac{3}{4}$-inch x 7-inch journals.
8 brasses, M. C. B. standard.
8 wedges, " " " "
8 box lids, Morris pressed steel.
4 steel brake beams, National hollow.

4 elliptic springs, quadruple, 4-ply.
8 equalizer " 8 inches x 10 inches, 3 coil.

STANDARD 4-WHEEL TRUCKS.

SUMMARY.

Lumber, white oak	785 feet.
Wrought iron forgings	4067 lbs.
" " rods and bolts	446 "
" " safety chains	70 "
Steel brake springs	104 "
Castings	3022 "
Steel wheels, 36 inches.	
Axles, hammered scrap, 3¾-inch x 7-inch journal	1650 "
Brasses, M. C. B., bronze	72 "
Wedges, " " " malleable iron	37 "
Box lids, Morris pressed steel.	
Brake beams, National hollow.	
Elliptic springs, quadruple 4-ply.	
Equalizer springs, 8 inches x 10 inches, 3 coil	510 "
Square nuts	100 "
Wrought washers	10 "
Flat-head screws	1 gross
Lubricating oil	10 gals.
Wool waste	15 lbs.
Paint material.	

LABOR.

STANDARD 6-WHEEL TRUCKS.

Detail Bill of Material.

DIMENSIONS.

Center to center of journals, 5 feet.
Steel wheels, 36 inches.
Journals, 4½ inches x 8 inches.
Brasses, 4¼ inches x 8 inches.
Steel brake beams.
Wheel pieces, plated both sides and top.
End sills, " top and bottom.
Bolsters, " 2 flitch plates.

LUMBER.

2 wheel pieces, white oak,	4	inches	x	7⅛	inches	x	14	feet	10	inches	.....	184	feet.
4 end sills,	5	"	x	9	"	x	6	"	11½	"	.....	131	"
4 cross timbers, " "	4½	"	x	8	"	x	6	"	7½	"	.....	107	"
4 bolster pieces, " "	4½	"	x	9	"	x	7	"	9	"	.....	137	"
8 " " " "	2¼	"	x	9	"	x	7	"	9	"	.....	143	"
2 " blocks, " "	8	"	x	9½	"	x	2	"	10½	"	.....	45	"
4 " " " "	2½	"	x	8	"	x	2	"	10½	"	.....	26	"
2 spring plank pieces, "	3	"	x	12	"	x	5	"	8½	"	.....	45	"
2 " " " "	3	"	x	11	"	x	5	"	8½	"	.....	41	"
8 safety beams, white "	3	"	x	10	"	x	4	"	3¾	"	.....	113	"
4 " " " "	3	"	x	7½	"	x	3	"	10½	"	.....	39	"
12 dust guards, elm,	9/16	"	x	6⅝	"	x	8¾	inches			.....	7	"
												1018	feet.

STANDARD 6-WHEEL TRUCKS.

Detail Bill of Material.

FORGINGS.

8 equalizers,	2	inches	x 5½	inches	x	5	feet	ctrs	.....	1636 lbs.
8 bolster plates,	¾	"	x 4	"	x	7	feet	9 inches		610 "
8 wheel piece plates, face,	⅜	"	x 7	"	x	14	"	8½ "		990 "
4 " " " top,	⅜	"	x 4¾	"	x	14	"	8½ "		364 "
4 cross timber "	⅜	"	x 4½	"	x	5	"	10 "		128 "
8 end sill "	½	"	x 5	"					.....	396 "
4 center plate block plates,	¾	"	x 8	"	x	2	feet	10 inches		188 "
8 cross truss rods,	⅞	inch	square, 1-inch ends						.....	142 "
4 cross sections,	1¼	"	x 6	inches					.....	732 "
4 center bearings,	1½	"	x 4	"					.....	916 "
4 side bearings,	2	"	x 3¼	"					.....	435 "
4 " " steel plates,	⅜	"	x 2	"					.....	11 "
2 carry irons, center fulcrum,	¾	"	x 4	"					.....	83 "
12 axle safety straps,	⅝	"	x 3	"					.....	167 "
4 pedestal tie bars,	1½	"	⅝	"	x 3½-inch ends				.....	440 "
4 " cross tie bars,	1	"							.....	72 "
12 brake hangers,	1	inch							.....	74 "
4 " " plates,	⅝	"	x 3	inches					.....	39 "
12 " " bolts,	1	"							.....	25 "
12 " beam safety straps,	¼	"	x 3	inches					.....	139 "
6 " " fulcrums,	¾	"	x 2½	"					.....	95 "
12 " " " rivets,	¾	"							.....	5 "
4 " " plates,	⅜	"	x 1½	inches					.....	7 "
4 " fulcrum safety straps,	1	"	square						.....	21 "
4 " balance spring stays,	1	"	"						.....	16 "
Weight carried forward									.....	7731 lbs.

STANDARD 6-WHEEL TRUCKS.

Detail Bill of Material.

FORGINGS—CONTINUED.

Weight brought forward		7731 lbs.
2 crescent fulcrums,	1 inch x 4 inches	136 "
4 " " rivets,	$\frac{3}{4}$ "	2 "
2 live levers,	1 " x 6 inches	79 "
2 balance levers,	1 " x $4\frac{1}{2}$ "	17 "
4 connection rods,	$1\frac{1}{8}$ "	85 "
4 " pins,	$1\frac{1}{2}$ "	11 "
24 " "	$1\frac{1}{8}$ "	26 "
12 brake springs,	$\frac{3}{8}$ inch x 3 inches	70 "
6 " release springs,	$\frac{3}{8}$ " x 3 "	50 "
8 " shoe keys,	$\frac{1}{8}$ " x 1 "	10 "
16 bolster hangers		342 "
4 " " bands,	$\frac{3}{4}$ inch x 3 inches	179 "
16 " " pins,	$1\frac{1}{4}$ "	25 "
8 " " " bottom,	2 "	124 "
8 " chafe plates,	$\frac{1}{8}$ " x 6 inches x 8 inches	15 "
16 washer plates,	$\frac{1}{4}$ " x 2 " x $7\frac{1}{2}$ "	16 "
8 check chains,	$\frac{5}{8}$ " 1-inch eye bolt	93 "
		9011 lbs.

SUMMARY OF FORGINGS.

Wrought iron, forgings	8798 lbs.
" " bolts	643 "
Steel, brake springs	120 "
Chain	93 "
Nuts and washers	205 "

STANDARD 6-WHEEL TRUCKS.

Detail Bill of Material.

CASTINGS.

12 pedestals	1932 lbs.
12 oil boxes	996 "
12 " " lid ferrules	5 "
2 center plates	199 "
8 spiral spring seats	168 "
8 " " caps	136 "
8 elliptic spring seats, bottom	56 "
8 " " " top	42 "
8 spring plank bearings	92 "
8 bolster hangers	52 "
8 " " caps	14 "
8 " chafe plates	48 "
8 brake hangers, outside	130 "
12 " shoes	307 "
4 truss rod saddles	20 "
16 " " washers	24 "
24 cast washers, ¾-inch	12 "
	4233 lbs.

MISCELLANEOUS.

12 steel wheels, 36 inches.	
6 scrap axles, 4¼-inch x 8-inch journals	2822 lbs.
12 brasses, M. C. B., 4¼ inches x 8 inches	149 "
12 wedges, " " " malleable iron	84 "
12 box lids, Morris pressed steel.	
8 elliptic springs, duplicate 36 inch, 5-ply	2157 "
8 spiral " 8 inches x 10½ inches, 3 coil	576 "
6 steel brake beams.	

STANDARD 6-WHEEL TRUCKS.

SUMMARY.

Lumber, white oak	1018 feet.
Wrought iron forgings	8798 lbs.
" " bolts	643 "
" " safety chains	93 "
Steel brake springs	120 "
Castings	4233 "
Steel wheels, 36 inches.	
Scrap axles, 4¼-inch x 8-inch journals	2822 "
Brasses, M. C. B., bronze	149 "
Wedges, " " " malleable	84 "
Box lids, Morris pressed steel.	
Elliptic springs, duplicate 36-inch, 5-ply	2157 "
Equalizer springs, 8 inches x 10½ inches, 3 coil	576 "
Square nuts	190 "
Wrought washers	15 "
Flat-head screws	1 gross
Brake beams, National hollow.	
Lubricating oil	15 gals.
Wool waste	22 lbs.
Paint material.	

LABOR.

STANDARD CABOOSE TRUCKS.

Detail Bill of Material.

DIMENSIONS.

Center to center of journals, 5 feet.
Cast-iron wheels, 600 lbs., 33 inches.
Journals, M. C. B., 4 inches x 7 inches.
Brasses, " " " 4 " x 7 "

LUMBER.

4 wheel pieces,	4½	inches	x	7¾	inches	x 8	feet	7½	inches.....	128	feet.
4 cross "	5¾	"	x	13	"	x 7	"	5	"	220	"
4 end "	4	"	x	6	"	x 7	"	3½	"	72	"
8 safety "	3	"	x	8	"	x 3	"	6	"	69	"
2 bolsters,	10	"	x	10½	"	x 5	"	6	"	115	"
2 spring plank,	3	"	x	12	"	x 5	"	6	"	44	"
8 dust guards,	⅝	"	x	5¾	"	x 9¼	inches.....			3	"
											651 feet.

FORGINGS.

4 equalizers,	2	inches	x 3	inches.....	550	lbs.
4 pedestal tie bars,	⅝	"	x 2½	"	234	"
8 bolster hangers,	1½	"	x 3	"	160	"
8 " " top pins,	1½	"	.....	22	"
4 " " bottom pins,	1½	"	x 3	inches.....	90	"
8 axle safety straps,	⅝	"	x 2½	"	120	"
8 cross timber angle plates,	⅝	"	x 5	"	120	"
8 " " truss rods,	⅞	"	.....	112	"
8 brake beam " "	⅝	"	.....	48	"
2 live levers,	1	"	x 3	inches.....	50	"
2 dead "	1	"	x 3	"	50	"
4 lever guides,	⅝	"	x 2½	"	42	"
Amount carried forward.....						1598 lbs.

STANDARD CABOOSE TRUCKS.

Detail Bill of Material.

FORGINGS—CONTINUED.

Amount brought forward			1598 lbs.
8 brake hangers,	$\frac{7}{8}$ inch	40 lbs.	
8 " safety chains and eyes,	$\frac{1}{2}$ "	20 "	
8 " springs (steel),	$\frac{3}{8}$ " x 2 inches	42 "	
4 " fulcrums,	$\frac{3}{4}$ " x $2\frac{1}{2}$ "	36 "	
2 " connection rods,	$\frac{7}{8}$ "	60 "	
10 " " pins,	$1\frac{1}{8}$ "	12 "	
			210 lbs.
			1808 lbs.
Bolts and nuts in trucks			150 "

CASTINGS.

8 pedestals	960 lbs.	
8 oil boxes	640 "	
2 center plates	125 "	
4 side bearings	80 "	
4 truss rod saddles	60 "	
8 " " washers	8 "	
16 bolster chafe plates	32 "	
8 " spring seats	72 "	
8 spiral " " top	160 "	
8 " " " bottom	240 "	
8 brake heads	168 "	
8 " shoes	160 "	
8 " beam washers	42 "	
4 " " truss rod saddles	34 "	
8 " hanger bearings	24 "	
Cast washers	22 "	
		2827 lbs.

STANDARD CABOOSE TRUCKS.

Detail Bill of Material.

SUMMARY.

Lumber, white oak	651 feet.
Wrought iron forgings	1808 lbs.
" " bolts	110 "
Castings	2827 "
Wheels, 33 inches, 600 lbs	4800 "
Axles, 4-inch x 7-inch journals	1520 "
Brasses, 4 inches x 7 inches, M. C. B., solid	72 "
Wedges	56 "
Elliptic springs, duplicate 28-inch x $6\frac{3}{4}$-inch, $\frac{3}{8}$-inch x 4-inch, 4 plts	564 "
Equalizer " 6 inches x 6 inches, 2 coil, $1\frac{1}{8}$ inches and $\frac{3}{4}$ inch	184 "
Nuts and washers	40 "
Lubricating oil	8 gals.
Waste	15 lbs.
Paint material	$1\frac{1}{2}$ gals.

LABOR.

CABOOSE PLATFORMS.

Detail Bill of Material.

LUMBER.

2 end timbers, white oak,	4½ inches x 6 inches x 8 feet 4 inches	46 feet.
4 center " " "	4½ " x 12 " x 12 "	248 "
4 inter. " " "	5 " x 12 " x 12 " 5 inches	286 "
4 step " " "	3 " x 8 " x 3 " 3 "	32 "
2 dead woods, " "	5 " x 5¾ " x 2 " 4 "	14 "
8 step treads, " "	1⅛ " x 8 " x 2 " 6 "	20 "
8 " risers, white pine,	1⅛ " x 16 " x 3 "	48 "
2 platform floors, yellow pine,	2 feet 3 inches x 5 feet 8 inches	30 "

FORGINGS.

4 platform hand rails,	½ inch x 2 inches	86 lbs.
8 " pillars,	1½ "	84 "
2 brake masts,	1¼ "	50 "
2 brake steps and carry irons,	1 " x 3 inches x 3 feet	60 "
2 buffer plates,	⅝ " x 4 " x 2 " 4 inches	40 "
4 followers,	1¼ " x 6 " x 9 inches	76 "
8 " guides,	½ " x 2 " x 1 foot 4 inches	32 "
2 coupler yokes,	1 " x 4 " x 1 " 4 "	90 "
Rods and bolts in platforms		240 "

CAST IRON.

8 draw lugs	112 lbs.
2 brake wheels	30 "
2 " ratchets	12 "
2 " pawls	4 "
8 pillar washers	12 "
2 M. C. B. couplers.	
2 draw springs, 6 inches x 8 inches, 2 coil	64 "

AVERAGE COST
OF
REPAIRS TO FREIGHT EQUIPMENT.

The following figures are based on Master Car Builders' prices and include the labor necessary to remove and replace the materials specified, together with the cost of new material and credit for scrap material removed, except as otherwise specified.

Estimates of material are based on a standard car of 60,000 pounds capacity, 35 feet long by 8 feet 9 inches wide. Side sills, 5 inches x 9 inches; center sills, 5 inches x 9 inches; intermediate sills, 4½ inches x 9 inches, where two sills are used, or 3 inches x 9 inches when four sills are used; end sills, 6 x 9 inches.

Where 4 inch x 8 inch sills are used, charge $1.00 less each sill.

FLOOR FRAME.

	Amount of Material.	Cost of Mate'l.	Cost of Applying.	Total Cost.
1 side sill	140 feet.	$ 3 50	$ 5 00	$ 8 50
2 " "	280 "	7 00	8 00	15 00
1 center sill	140 "	3 50	6 40	9 90
2 " "	280 "	7 00	7 60	14 60
1 intermediate sill	128 "	3 20	5 80	9 00
2 " "	256 "	6 40	7 00	13 40
3 " "	264 "	6 62	8 20	14 82
4 " "	352 "	8 80	9 40	18 20
1 side and 1 center sill	280 "	7 00	9 60	16 60
1 " " 2 " "	420 "	10 50	10 60	21 10
2 " " 1 " "	420 "	10 50	13 60	24 10
2 " " 2 " "	560 "	14 00	14 20	28 20
1 " sill replaced, same sill			5 00	5 00
2 " " " " "			8 00	8 00
1 " " spliced, 12-foot splice	48 "	1 20	2 40	3 60
1 inter " " 12 " "	40 "	1 00	2 20	3 20

REPAIRS TO FREIGHT EQUIPMENT.

FLOOR FRAME—CONTINUED.

	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
1 side and 1 intermediate sill	268 feet.	$ 6 70	$ 8 80	$15 50
1 " " 2 " "	396 "	9 90	10 00	19 90
1 " " 3 " "	404 "	10 10	11 20	21 30
1 " " 4 " "	492 "	12 30	12 40	24 70
2 " " 1 " "	408 "	10 20	11 60	21 80
2 " " 2 " "	536 "	13 40	12 80	26 20
2 " " 3 " "	544 "	13 60	14 00	27 60
2 " " 4 " "	632 "	15 80	15 20	31 00
1 side, 1 inter. and 1 center sill	408 "	10 20	10 60	20 80
2 " 1 " " 1 " "	548 "	13 70	14 80	28 50
1 " 2 " " 1 " "	536 "	13 40	11 60	25 00
2 " 2 " " 1 " "	676 "	16 90	15 20	32 10
1 " 3 " " 1 " "	544 "	13 60	12 60	26 20
2 " 3 " " 1 " "	684 "	17 10	16 20	33 30
1 " 4 " " 1 " "	632 "	15 80	13 60	29 40
2 " 4 " " 1 " "	772 "	19 30	17 20	36 50
1 " 1 " " 2 " "	548 "	13 70	11 60	25 30
2 " 1 " " 2 " "	688 "	17 20	15 20	32 40
1 " 2 " " 2 " "	676 "	16 90	12 60	29 50
1 " 3 " " 2 " "	684 "	17 10	13 80	30 90
1 " 4 " " 2 " "	772 "	19 30	14 80	34 10
2 " 2 " " 2 " "	816 "	20 40	16 20	36 60
2 " 3 " " 2 " "	824 "	20 60	17 20	37 80
2 " 4 " " 2 " "	912 "	22 80	18 20	41 00

REPAIRS TO FREIGHT EQUIPMENT—CONTINUED.

FLOOR FRAME—CONTINUED.

	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
1 inter and 1 center sill	268 feet.	$ 6 70	$ 7 60	$14 30
1 " " 2 " "	408 "	10 20	8 80	19 00
2 " " 1 " "	396 "	9 90	8 60	18 50
2 " " 2 " "	536 "	13 40	10 00	23 40
3 " " 1 " "	404 "	10 10	9 60	19 70
3 " " 2 " "	544 "	13 60	12 00	25 60
4 " " 1 " "	492 "	12 30	12 00	24 30
4 " " 2 " "	632 "	15 80	13 00	28 80
1 " or 1 " " when air brake is removed extra			75	75
1 sub sill or draft timber extension	18 "	45	30	75
1 body bolster, wood, old truss rods and castings	56 "	1 40	1 60	3 00
1 body bolster, wood, old truss rods and castings, when sills are replaced	56 "	1 40	40	1 80
1 body bolster, new truss rods and castings		3 40	1 60	5 00
1 body bolster, new truss rods and castings, when sills are replaced		3 40	40	3 80
1 body bolster, same bolster replaced with sills			40	40
1 " " composite (wood with plates)		8 25	2 00	10 25
1 " " " when sills are replaced		8 25	80	9 05
1 body bolster, metal, 1 inch x 8 inches, old castings. No credit	480 lbs.	14 40	1 60	16 00
1 body bolster, metal, 1 inch x 8 inches, new castings. No credit		16 80	1 60	18 40
1 body bolster, metal, 1 inch x 8 inches, when sills are replaced		16 80	40	17 20
1 body bolster, metal, 1 inch x 6 inches, old castings. No credit	362 lbs.	10 86	1 60	12 46
1 body bolster, metal, 1 inch x 6 inches, new castings. No credit		13 26	1 60	14 86
1 pressed steel, Schoen	575 "	16 50	1 60	18 10

REPAIRS TO FREIGHT EQUIPMENT.

FLOOR FRAME—CONTINUED.

	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
1 end sill under siding	44 feet.	$ 1 10	$ 3 00	$ 4 10
1 " " outside "	54 "	1 35	1 40	2 75
1 " " " " when sills are renewed	54 "	1 35	40	1 75
1 " " under " " " " "	44 "	1 10	60	1 70
1 cross tie timber	34 "	85	40	1 25
1 " " " when sills are removed	34 "	85	20	1 05
1 dead wood	10 "	25	40	65
1 draft timber for wood bolster	22 "	55	1 20	1 75
2 " " same end, for wood bolster	44 "	1 10	1 80	2 90
1 draft timber for iron bolster	30 "	75	1 20	1 95
2 " " same end, for iron bolster	60 "	1 50	1 80	3 30
1 draft timber for American continuous	30 "	75	1 20	1 95
2 " " same end, for American continuous	60 "	1 50	1 80	3 30
1 new floor, complete, box car	720 "	18 00	2 50	20 50
1 " " " coal "	720 "	18 00	2 50	20 50
1 " " " flat "	720 "	18 00	2 00	20 00
Repairing floor box car, per foot	18 "	45	20	65
" " flat " " "	18 "	45	10	55

REPAIRS TO FREIGHT EQUIPMENT.

COAL CAR FLOOR FRAME.

	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
1 side sill, coal car, 5 in. x 12 in. x 35 ft.....	188 feet.	$ 4 70	$ 5 00	$ 9 70
1 " " " " 5 in. x 14 in. x 35 ft	218 "	5 45	5 00	10 45
1 side plank, coal car, 3 in. x 10½ in. x 34 ft.....	100 "	2 50	1 00	3 50
2 " " " " 3 in. x 10½ in. x 34 ft.....	200 "	5 00	1 50	6 50
3 " " " " 3 in. x 10½ in. x 34 ft.....	300 "	7 50	2 00	9 50
4 " " " " 3 in. x 10½ in. x 34 ft.....	400 "	10 00	2 50	12 50
1 side plank, coal car, 3 in. x 12 in. x 34 ft.....	116 "	2 90	1 00	3 90
2 " " " " 3 in. x 12 in. x 34 ft.....	232 "	5 80	1 50	7 30
3 " " " " 3 in. x 12 in. x 34 ft.....	348 "	8 70	2 00	10 70
Removing and replacing same plank.....			75	75
1 end plank, coal car, 3 in. x 10½ in. x 8 ft. 6 in.	26 "	65	15	80
2 " " " " 3 in. x 10½ in. x 8 ft. 6 in.	52 "	1 30	30	1 60
3 " " " " 3 in. x 10½ in. x 8 ft. 6 in.	78 "	1 95	45	2 40
4 " " " " 3 in. x 10½ in. x 8 ft. 6 in.	104 "	2 60	60	3 20
When plank are equipped with corner irons charge labor extra for each plank.....			10	10
When new bolts are required charge per plank.		35		35
1 end gate, complete, 42 in. wide, old irons.....	104 "	2 60	60	3 20
1 " " " 36 in. " " "	90 "	2 25	45	2 70
1 " " cross rod, ⅞ in. x 9 ft.....	18 lbs.	54	10	64
1 side or end stake.....	8 feet.	20	10	30
1 " " " " with new bolts		35	10	45

REPAIRS TO FREIGHT EQUIPMENT.

DRAFT RIGGING.

These prices include credit for scrap.	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
1 draft timber, old castings and bolts		$ 0 75	$ 1 20	$ 1 95
2 " " same end, old castings and bolts		1 50	1 80	3 30
1 " " new castings, old bolts		1 05	1 20	2 25
2 draft timbers, same end, new castings, old bolts.		2 10	1 80	3 90
1 draft timber, new castings and bolts, old straps		1 77	1 20	2 97
2 draft timbers, same end, new castings and bolts, old straps		3 54	1 80	5 34
2 draft timbers, new castings and forgings, followers and spring		4 81	1 80	6 61
1 draft timber, American continuous		75	1 20	1 95
2 " " same end, American continuous		1 50	1 80	3 30
Replacing draft timber bolts, one end		72	60	1 32
" draw bar or coupler, labor			40	40
1 M. C. B. coupler, complete, average		10 00	40	10 40
1 " " " knuckle, average		2 80		2 80
1 coupler yoke or pocket, average	45 lbs.	1 01	40	1 41
1 " draw stem, "	16 "	36	40	76
1 cast draw bar, average	200 "	2 00	40	2 40
1 malleable draw bar, average	130 "	3 40	40	3 80
1 follower, average	16 "	36	40	76
1 " guide plate, average	4 "	09	10	19
1 draw rod, American continuous, average	152 "	3 42	40	3 82
1 " " key, American continuous, average	32 "	72	20	92
1 " lug, average	15 "	34	40	74
1 " " bolt, average	1¾ "	04	10	14
1 " timber bolt	4½ in.	10	20	30
1 draw spring, 6 inches x 6 inches, 2 coil	23 lbs.	57	40	97
1 " " 6 " x 8 " 2 "	32 "	80	40	1 20

REPAIRS TO FREIGHT EQUIPMENT.

END OF CAR.

These prices include credit for scrap.	Cost of Material.	Cost of Labor.	Total Cost.
1 corner post	$ 0 40	$ 0 60	$ 1 00
1 end post	20	60	80
1 " brace	20	60	80
1 " plate	87	2 40	3 27
1 end siding (painted and trimmed)	3 50	50	4 00
1 " " patching per running foot	40	10	50
1 " lining, complete, 3 feet high	75	25	1 00
2 end posts and 2 braces	80	1 20	2 00
2 " " 2 " and 2 corner posts	1 60	2 00	3 60
2 end posts, 2 braces, 2 corners, belt rail and end plate	2 70	3 30	6 00
All posts and braces, siding and lining complete	6 95	4 05	11 00
All posts and braces, end plate, siding and lining complete	7 80	5 20	13 00
1 dead wood	25	25	50
1 end sill under siding	1 10	3 00	4 10
1 " " and dead wood	1 35	3 20	4 55
1 " " " " " carry iron and bolts	3 00	3 25	6 25
1 end sill, dead wood, 1 draw timber, old castings and forgings	3 75	4 45	8 20
1 end sill, dead wood, 2 draw timbers, old castings and forgings	4 50	5 00	9 50
1 end sill, dead wood, 2 draw timbers, new castings, old forgings	5 10	5 00	10 10
1 end sill, dead wood, 2 draw timbers, new castings and new forgings	7 82	5 00	12 82
1 end sill, draft timbers and attachments, and end of car	15 62	10 20	25 82
1 end sill, draft timbers and attachments, and end of car without E plate	14 75	9 05	23 80
1 end sill, draft timbers and attachments, and end of car and 1 center sill	19 12	15 45	34 57
1 end sill, draft timbers and attachments, and end of car and 2 center sills	22 62	16 65	39 27
1 end sill, draft timbers and attachments, and 1 center sill	11 32	11 40	22 72
1 end sill, draft timbers and attachments, and 2 center sills	14 82	12 60	27 42

NOTE.—Couplers or springs not included in above prices.

REPAIRS TO FREIGHT EQUIPMENT.

MATERIAL IN BODY ABOVE SILLS.

	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
1 side plate	80 feet.	$ 2 00	$ 5 00	$ 7 00
1 " " spliced, 12-foot splice	24 "	60	2 00	2 60
1 end plate	35 "	87	2 40	3 27
1 carline	16 "	40	60	1 00
1 door post	16 "	40	60	1 00
1 corner post	16 "	40	60	1 00
1 side post	8 "	20	60	80
1 end post	8 "	20	60	80
1 side brace	12 "	30	60	90
1 end brace	8 "	20	60	80
1 section of belt rail, 15 feet	15 "	37	38	75
1 " " " " 8 "	9 "	23	27	50
1 inside lining, complete sides and ends	280 "	7 30	1 70	9 00
1 " " section door to corner, 3 feet high	56 "	1 46	34	1 80
1 " " one end of car, 3 feet high	28 "	75	25	1 00
1 " " " " " 7 " "	64 "	1 66	59	2 25
Patching, per board, on side	8 "	20	05	25
" " " " end	4 "	10	05	15
Siding car, complete, moulding and painting	720 "	32 00	4 00	36 00
" one end complete, moulding and painting	80 "	3 50	50	4 00
" " section door to corner and painting	140 "	6 25	75	7 00
" patching, per board	4 "	20	05	25
Painting, S. & W. paint, per coat		2 00	50	2 50

REPAIRS TO FREIGHT EQUIPMENT.

MATERIAL IN ROOFS ABOVE CARLINES.

	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
1 double board roof	800 feet.	$29 25	$ 3 75	$33 00
1 single " " over iron or paper	400 "	11 50	2 00	13 50
1 " " " under " " "	360 "	9 50	2 00	11 50
Patching " " per board	2½ "	07	05	12
1 running board and cleats, 24 inch	80 "	2 00	25	2 25
1 ridge clamp, for inside iron roof	40 "	1 00	15	1 15
6 roof ribs, for inside iron or paper roof	80 "	2 00	35	2 35
40 sub rafters for " " " "	100 "	2 50	1 00	3 50
20 sheets roof iron, for inside iron		18 00	50	18 50
Paint stock		1 00	25	1 25
1 ridge pole	35 "	87	13	1 00
1 purline	18 "	45	10	55
1 side fascia, for iron or paper door to corner	16 "	40	30	70
1 end " " " " "	12 "	30	20	50
1 side " double board door to corner	8 "	20	20	40
1 end " " "	4 "	10	10	20

NOTE.—Above prices include paint and nails.

AVERAGE COST OF ROOFS, 35-FOOT CARS.

Including all labor and material above side plates and carlines.

STYLE OF ROOF.	Actual Cost of Lumber.	M. C. B. Cost of Lumber.	Nails and Paint.	Iron, Paper or Tin.	Labor.	Actual Cost.	M. C. B. Cost.
Outside iron roof	$ 7 00	$11 00	$2 50	$21 00	$4 50	$35 00	$39 00
Inside " "	12 50	17 50	2 25	18 00	4 25	37 00	42 00
Paper roof with air space	19 00	26 50	2 25	10 00	4 25	35 50	43 00
" " without "	13 50	21 00	2 50	10 00	4 00	30 00	37 50
Tin roof	7 00	11 00	4 00	16 00	5 00	32 00	36 00
Double board roof	26 75	22 00	2 50		3 75	33 00	28 25

REPAIRS TO FREIGHT EQUIPMENT.

Material in Doors.

	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
BATTENED DOOR, BOX CAR.				
Lumber, white pine	66 feet.	$1 65		
Nails, 8D clinch	3 lbs.	09		
Hangers, cast iron	12 "	18		
Wrought iron chafe strip and bolts	6 "	18		
Door lock, Cleveland		10		
Labor			$0 75	
				$2 95
M. C. B. price applied				3 50
FRAME DOOR WITH RODS, BOX CAR.				
Lumber, oak	35 feet.	87		
Wrought iron, rods and bolts	92 lbs.	2 76		
Hangers, cast iron	12 "	18		
Door lock, Cleveland		10		
Labor			1 00	
				4 91
M. C. B. price applied				5 00
FRAME DOOR WITH SLATS, STOCK CAR.				
Lumber, oak	47 feet.	1 18		
Wrought iron, rods and bolts	14 lbs.	42		
Hangers, cast iron	12 "	18		
Screws	¼ gross	12		
Labor			1 00	
				2 90
M. C. B. price applied				4 00
End door battened, price applied				1 75
" " framed, rods, price applied				3 00
Rehanging one side door, labor				20
1 door cap	8 feet.	20	10	30
1 " stop	4 "	10	10	20

AVERAGE WEIGHTS AND PRICES.

RODS AND BOLTS THAT REQUIRE RENEWALS.

		Weight.	Cost.
1 side brace rod,	$\frac{7}{8}$ inch x 9 feet 3 inches	19 lbs.	$0 57
1 " " "	$\frac{3}{4}$ " x 9 " 3 "	14 "	42
1 side tie rod,	$\frac{7}{8}$ inch x 9 feet	18 "	54
1 " " "	$\frac{7}{8}$ " x 8 " 3 inches	17 "	51
1 " " "	$\frac{3}{4}$ " x 9 "	13 "	39
1 " " "	$\frac{3}{4}$ " x 8 " 3 inches	12 "	36
1 " " "	$\frac{5}{8}$ " x 9 "	9 "	27
1 " " "	$\frac{5}{8}$ " x 8 " 3 inches	8 "	24
1 cross tie rod,	$\frac{5}{8}$ inch x 8 feet 10 inches	9 "	27
1 " " "	$\frac{1}{2}$ " x 8 " 10 "	6 "	18
1 drawbar pocket bolt,	1 inch x 10 inches	$3\frac{1}{4}$ "	10
1 " " "	$\frac{7}{8}$ " x 10 "	$2\frac{1}{2}$ "	08
1 draft timber bolt,	$\frac{7}{8}$ inch x 16 inches	4 "	12
1 " " "	$\frac{7}{8}$ " x 17 "	$4\frac{1}{4}$ "	13
1 " " "	$\frac{7}{8}$ " x 18 "	$4\frac{1}{2}$ "	14
1 " " "	$\frac{7}{8}$ " x 20 "	5 "	15
1 " " "	$\frac{7}{8}$ " x 22 "	$5\frac{1}{2}$ "	16
1 draft lug bolt,	$\frac{3}{4}$ inch x 7 inches	$1\frac{1}{2}$ "	04
1 " " "	$\frac{3}{4}$ " x 9 "	$1\frac{3}{4}$ "	05
1 " " "	$\frac{3}{4}$ " x 10 "	2 "	06
1 " " "	$\frac{3}{4}$ " x 12 "	$2\frac{1}{4}$ "	07
1 " " "	$\frac{3}{4}$ " x 14 "	$2\frac{1}{2}$ "	08
1 " " "	$\frac{3}{4}$ " x 16 "	$2\frac{3}{4}$ "	09

AVERAGE WEIGHTS AND PRICES.

MATERIAL IN BODY.

	Weight.		Cost.
1 body bolster, top bar, 1 in. x 8 in. x 8 ft. 9 in.....	260 lbs.		
bottom bar, 1⅛ in. x 8 in. x 8 ft. 2 in.....	247 "	507 lbs.	$15 21
1 body bolster, top bar, 1 in. x 8 in. x 8 ft. 9 in.....	260 "		
bottom bar, 1 in. x 8 in. x 8 ft. 2 in.....	220 "	480 "	14 40
1 body bolster, top bar, ⅞ in. x 8 in. x 8 ft. 9 in.....	226 "		
bottom bar, 1 in. x 8 in. x 8 ft. 2 in.....	220 "	446 "	13 38
1 body bolster, top bar, ¾ in. x 8 in. x 8 ft. 9 in.....	195 "		
bottom bar, ⅞ in. x 8 in. x 8 ft. 2 in.....	192 "	387 "	11 61
1 body bolster, top bar, 1 in. x 6 in. x 8 ft. 9 in.....	194 "		
bottom bar, 1 in. x 6 in. x 8 ft. 2 in.....	165 "	359 "	10 77
1 body bolster, top bar, ⅞ in. x 6 in. x 8 ft. 9 in.....	170 "		
bottom bar, 1 in. x 6 in. x 8 ft. 2 in.....	165 "	335 "	10 05
1 body bolster, pressed steel, Schoen.....		575 "	16 50
1 body bolster, cast steel, S. H. & H.....			
1 body bolster, cast steel, American.....			
2 "Graham" steel followers.....		33 "	1 81
2 "Butler" pockets, malleable, 4 pieces.....		132 "	3 96
4 " followers, cast iron.....		56 "	84

AVERAGE WEIGHTS AND PRICES.

MATERIAL IN BODY.

	Weight.	Cost.
1 truss rod, 1⅜ inch rd. 36 feet long with turnbuckle	190 lbs	$5 70
1 " " 1¼ " " 36 " " " "	160 "	4 80
1 " " 1⅛ " " 36 " " " "	130 "	3 90
1 " " 1 " " 36 " " " "	110 "	3 30
1 " " 1⅛ " " 9 " 10 inches long for body bolster	33 "	99
1 " " 1 " " 9 " 10 " " " " "	26 "	78
1 " " ⅞ " " 9 " 10 " " " " "	19 "	57
1 draft rod, 1¼ in. rd. 31 ft. 6 in., American continuous	152 "	4 56
1 " " key, 1 in. x 5 in. x 2 ft. 1 in. " "	32 "	96
1 brake mast, 1⅜ inch rd. x 11 feet 10 inches	60 "	1 80
1 " " 1¼ " " x 11 " 10 "	50 "	1 50
1 " " 1¼ " " x 5 "	21 "	63
1 king bolt, 1¾ inch rd. x 2 feet 8 inches	21 "	63
1 " " 1¾ " " x 2 " 6 "	20 "	60
1 " " 1¾ " " x 2 " 2 "	17 "	51
1 " " 1¾ " " x 2 "	16 "	48
1 draw spindle, 1¾ inch rd. x 1 foot 6 inches	18 "	
1 " " 1¾ " " x 1 " 4 "	16 "	
1 drawbar pocket, 1⅛ inches x 4 inches x 1 foot 4 inches	50 "	1 50
1 " " 1⅛ " x 4 " x 1 " 2 "	45 "	1 35
1 " " 1 " x 4 " x 1 " 4 "	45 "	1 35
1 " " 1 " x 4 " x 1 " 2 "	40 "	1 20
1 follower plate, 1½ inches x 6 inches x 9 inches	23 "	69
1 " " 1¼ " x 6 " x 9 "	19 "	57
1 " " 1 " x 6 " x 9 "	15 "	45
1 " " guide, ½ " x 2 " x 1 foot 2 inches	4 "	12

AVERAGE WEIGHTS AND PRICES.

MATERIAL IN BODY.

		Weight.	Cost.
1 carry iron,	¾ inch x 3 inches x 2 feet	15 lbs	$0 45
1 " "	1 " x 3 " x 2 "	20 "	60
1 " "	1 " x 3 " x 3 "	30 "	90
1 corner iron,	⅜ inch x 9 inches x 2 feet 4 inches	26 "	78
1 " "	¼ " x 9 " x 2 " 4 "	17 "	51
1 " "	3/16 " x 10 " x 2 "	14 "	42
1 " "	¼ " x 5 " x 1 " 6 inches	6 "	18
1 " "	¼ " x 4 " x 1 " 6 "	5 "	15
1 " "	⅜ " x 3 " x 1 " 6 "	6 "	18
1 " "	⅜ " x 2½ " x 1 " 6 "	5 "	15
1 " "	9 inches, Schoen pressed steel		40
2 " " coal sides,	6 " " " "		30
2 " " " "	4 " " " "		20
1 door track,	⅜ inch x 3 inches x 11 feet	42 "	1 26
1 " "	⅜ " x 2½ " x 11 "	35 "	1 05
1 " "	⅜ " x 2 " x 11 "	28 "	84
1 " "	⅜ " x 2 " x 5 "	13 "	39
1 " "	¼ " x 2 " x 5 "	8 "	24
1 threshold plate,	⅜ inch x 4 inches x 5 feet 6 inches	28 "	84
1 " "	¼ " x 4 " x 5 " 6 "	19 "	57
1 sill step,	⅜ inch x 2½ inches x 3 feet	9 "	27
1 " "	⅜ " x 2 " x 3 "	8 "	24
1 grab handle,	⅝ inch rd. x 24 inch centers	3 "	09
1 " "	⅝ " " x 18 " "	2 "	06
1 uncoupling rod, 1-inch rd.		16 "	48

AVERAGE WEIGHTS AND PRICES.

MATERIAL IN BODY.

	Weight.	Cost.
1 cast iron center plate, wood bolster, 4 holes	70 lbs	$1 10
1 " " " " " " 2 "	65 "	98
1 " " " " iron " 4 "	64 "	96
1 " " " " " " 2 "	60 "	90
1 malleable " " " " 4 "	47 "	1 41
1 " " " " " 2 "	35 "	1 05
1 pressed steel center plate		
1 cast iron side bearing, wood bolster	14 "	21
1 " " " " iron "	29 "	44
1 malleable " " " "	15 "	45
1 queen post, cast iron	24 "	36
1 " " " "	12 "	18
1 " " malleable	10 "	30
1 " " "	5 "	15
1 drawbar, cast iron, American continuous	215 "	3 22
1 " " "	175 "	2 62
1 " malleable, American continuous	160 "	4 80
1 " "	105 "	3 15
1 draft lug, cast iron, 3-hole	14 "	21
1 " " " " square	20 "	30
1 " " malleable	8 "	24
1 draft timber key, cast iron	5 "	08
1 stake pocket, cast iron, single U-bolt	13 "	20
1 " " " " double U-bolt	15 "	22
1 " " malleable " "	8 "	24
1 " " pressed steel, double U-bolt	5 "	
1 " " " " single "	4 "	

AVERAGE WEIGHTS AND PRICES.

STANDARD BRAKE RIGGING FOR AIR BRAKES.

		Weight.	Cost.
1 push rod,	1⅜ inch rd. x 2 feet 8 inches	22 lbs	$0 66
1 cylinder rod,	¾ " " x 7 " 6 "	26 "	78
2 top rods,	¾ " " x 9 " 6 "	59 "	1 77
1 hand rod,	¾ " " x 11 " 2 "	24 "	72
1 release rod,	⅜ " " x 4 " 9 "	2 "	06
1 cylinder lever,	1 inch x 3¼ inches x 2 feet 11 inches	32 "	96
1 reservoir "	1 " x 3¼ " x 2 " 8 "	28 "	84
1 " fulcrum,	½ " x 2½ " x 3 " 4 "	14 "	42
3 lever guides,	1 " rd. x 3 feet 7½ inches	27 "	81
19 connection pins,	1⅛ inch rd. x 4½ inches	21 "	63
5 pipe clamps,	½ " x 1½ inches	9 "	27
2 dummy hangers,	⅜ " x 2 "	4 "	12
1 set of bolts		34 "	1 02
2 live levers,	1 inch x 3¾ inches x 2 feet 6 inches	58 "	1 74
2 dead "	1 " x 3¾ " x 2 "	44 "	1 32
2 " " guides,	⅞ " rd. x 2 feet 4 inches	34 "	1 02
2 bottom rods,	⅞ " " x 5 "	50 "	1 50
8 brake hangers,	⅞ inch rd. x 1 foot 6 inches	52 "	1 56
8 " safety chains,	½ " " x 1 " 6 "	26 "	78
8 " hanger eyes,	1 " "	26 "	78
8 " shoe keys,	½ " x ⅞ inches x 9½ inches	8 "	24
8 brake shoes, cast iron		160 "	2 40
4 brake beams, metal			14 00

AVERAGE WEIGHTS AND PRICES.

OLD STYLE HAND BRAKES.

		Weight	Cost.
BRAKE RIGGING, SINGLE TRUCK.			
1 live lever,	⅝ inch x 3 inches x 2 feet 11 inches	15 lbs.	$0 45
1 dead lever,	⅝ " x 3 " x 2 " 11 "	15 "	45
1 bottom rod,	¾ " rd. x 7 " 3 "	15 "	45
1 top rod,	⅝ " rd. x 7 " 3 "	9 "	27
BRAKE RIGGING, DOUBLE TRUCKS.			
2 live levers,	⅝ inch x 3 inches x 2 feet 11 inches	30 "	90
2 dead levers,	⅝ " x 3 " x 2 " 11 "	30 "	90
2 bottom rods,	¾ " rd. x 7 " 3 "	30 "	90
1 top rod,	⅝ " rd. x 20 " 0 "	22 "	66
1 top rod,	⅝ " rd. x 7 " 3 "	9 "	27
1 equalizing lever,	⅝ " x 2½ " x 17½ "	7 "	21

NOTE.—Many of the old cars, equipped with hand brakes, have no dead levers, bottom rod extends through one brake beam. Weight of material about the same.

COST OF ONE PLAIN WOOD BRAKE BEAM COMPLETE.

1 brake beam,	oak,	3½ in. x 7 in.	x 5 ft. 11 in.	14 lbs.	$0 35
1 " fulcrum,	wrought iron,	⅝ " x 2½ "	x 1 " 10 "	7 "	21
2 " beam guides,	" "	⅞ " rd.	x 1 " 2 "	4 "	12
2 " " hook bolts,	" "	⅝ " "	x 10½ "	2 "	06
2 " head bolts,	" "	¾ " "	x 6 "	2½ "	07
2 " heads,	cast iron			40 "	60
3 " shoes,	" "			40 "	60
Labor fitting up brake beam					15
					$2 16
Add 10 per cent					22
					$2 38

COST OF STANDARD AIR BRAKES.

APPLIED TO CAR.

Westinghouse automatic equipment, schedule H 1	$36 00
Train pipe, 1¼ inches x 38 feet	1 50
Pressure pipe, ⅜ " x 27 "	50
Ells and unions	40
Cylinder blocks, oak	20
Body forgings, brakes hung to body	12 42
Truck "	5 58
Brake beams, metal	14 00
" shoes	2 40
Labor applying brakes to car	5 00
	$78 00

COST OF ONE WOOD TRUSSED BRAKE BEAM, COMPLETE.

1 brake beam, oak,	3½ in. x 7 in. x 5 ft. 11 in.	14	feet.	$0 35
1 " fulcrum, wrought iron,	¾ in. x 2½ in. x 1 ft. 10 in.	9	lbs.	27
2 " truss rods,	⅝ in. rd. x 6 ft. 4½ in.	12	"	36
2 " guides,	⅞ in. rd. x 1 ft. 2 in.	4	"	12
2 " hook bolts,	⅝ in. rd. x 10½ in.	2	"	06
2 " head "	¾ in. rd. x 6 in.	2½	"	07
2 brake beam washers, cast iron		10	"	15
1 truss rod saddle, cast iron		8	"	12
2 brake heads, " "		40	"	60
2 " shoes, " "		40	"	60
Labor fitting up brake beam				25
				$2 95
Add 10 per cent				29
				$3 24

WESTINGHOUSE FREIGHT CAR BRAKE EQUIPMENT.

Repair Prices.

STANDARD COMBINED CYLINDER AND RESERVOIR, PLATE F 40.

Equipment for car complete, schedule H 1		$40 00
Cylinder, reservoir and triple valve, complete,	plate F 40, No. 1	26 50
Cylinder body,	" " 40, " 2	3 00
Piston head and rod,	" " 40, " 3	2 00
Back head,	" " 40, " 4	1 00
Release spring,	" " 40, " 9	1 00
Reservoir,	" " 40, " 10	3 35
Triple valve complete,	plate F 36, No. 1	15 00
Triple valve body,	" " 36, " 2	5 50
Slide valve for triple valve,	" " 36, " 3	1 00
Piston " " "	" " 36, " 4	2 00
Drain cup " " "	" " 36, " 19	75
Hose and coupling, 1¼-inch complete, each,	plate F 43, No. 1	2 12
Coupling, standard 1¼ " each,	" " 43, " 2	75
Hose, " 1¼ " "	" " 43, " 3	1 25
Nipple, " 1¼ " "	" " 43, " 4	15
Angle cock, " 1¼ " complete, each,	" " 43, " 6	2 00
" " body, each,	" " 43, " 6	1 10
" " key, "	" " 43, " 6	50
Cut-out cock, 1¼-inch complete,	plate F 43, No. 7	1 50
Drain cup, 1¼ "	" " 43, " 9	1 25
Drain cup body,	" " 43, " 9	80
Release valve complete,	" " 43, " 10	1 00
Pressure retaining valve,	" " 43, " 11	1 25

WESTINGHOUSE FREIGHT CAR BRAKE EQUIPMENT.

Repair Prices.

SPECIAL DETACHED CYLINDER AND RESERVOIR, PLATE F 41.

Equipment for car complete, schedule H 2		$40 00
Cylinder, reservoir and triple valve, complete,	plate F 41	26 50
Cylinder, complete,	" " 41, No. 1	9 00
Cylinder body,	" " 41, " 2	3 00
Piston head and rod,	" " 41, " 3	2 00
Back head,	" " 41, " 4	1 00
Front head,	" " 41, " 12	65
Auxiliary reservoir,	" " 41, " 13	3 70
Triple valve, complete,	plate F 36, No. 1	15 00
" " body,	" " 36, " 2	5 50
Hose and coupling, 1¼-inch, complete, each		2 12
Standard hose, 1¼ "	"	1 25
" " 1 "	"	1 00
" coupling, 1¼ "	"	75
Angle cock, 1¼-inch, each		2 00
" " body		1 10
" " key		50
" " handle		10
Cut-out cock, 1¼-inch, complete, each		1 50
" " body		70
" " key		50
Drain cup, complete		1 25
Release valve, complete		1 00
Pressure retaining valve, complete		1 25
One air hose coupling		80

WESTINGHOUSE FREIGHT CAR BRAKE EQUIPMENT.

REPAIR PRICES.

	Cost of Material.	Cost of Labor.	Total Cost.
Angle cock, renewing	$ 2 00	$ 0 05	$ 2 05
" " handle, "	10	05	15
Coupling dummy, "	10	05	15
Cut-out cock, "	1 50	15	1 65
" " handle, "	08	05	13
Reservoir, "	3 35	25	3 60
Cylinder body, "	3 00	25	3 25
" release spring, "	1 00	10	1 10
" gasket, "	06	20	26
Check valve case, "	90	10	1 00
" " " gasket, "	08	10	18
Coupling gasket, "	04	03	07
Pipe, one section, 16 feet, renewing	64	10	74
" securing to body		10	10
Piston, renewing	2 00	10	2 10
" packing leather, "	40	15	55
Pressure retaining valve, repairing		15	15
Release valve, "		10	10
" " rod, "		10	10
Strainer, renewing	10	05	15
Triple valve gasket, "	12	10	22
Triple slide valve, repairing		40	40
" emergency valve seat, repairing		10	10
Triple valve, cleaning and oiling		10	10
Cylinder " " "		15	15

REPAIRS TO FREIGHT TRUCKS.

BOLSTERS AND SPRING PLANK.

	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
1 truck bolster, oak, 9 in. x 14 in. x 7 ft. 6 in.....	80 in.	$2 00	$2 00	$4 00
1 " " " 10 in. x 12 in. x 7 ft. 6 in.....	82 feet.	2 05	2 00	4 05
1 " " " 9 in. x 12 in. x 7 ft. 6 in.....	74 "	1 85	2 00	3 85
1 " " " 9 in. x 12 in. x 5 ft. 4 in.....	53 "	1 32	2 00	3 32
1 " " " 8 in. x 12 in. x 5 ft. 4 in.....	47 "	1 17	2 00	3 17
Above prices do not include truss rods or castings, center or side bearings.				
1 truck bolster pressed steel, 7 ft. 6 in., Schoen.....	575 lbs.	16 50	2 00	18 50
1 " " cast " 7 ft. 6 in., American.	587 "		2 00	
1 " " " " 7 ft. 6 in., S. H. & H.			2 00	
1 truck transom, oak, 5 in. x 14 in. x 7 ft. 6 in.....	46 feet.	1 15	2 00	3 15
1 " " " 5 in. x 12 in. x 7 ft. 6 in.....	41 "	1 02	2 00	3 02
1 truck transom, channel, ½ in. x 10½ in. x 6 ft. 7 in.	142 lbs.	4 26	3 00	7 26
1 " " " ⅜ in. x 10½ in. x 6 ft. 7 in.	130 "	3 90	3 00	6 90
1 spring plank, oak, 5 in. x 14 in. x 7 ft. 6 in.....	46 feet.	1 15	2 00	3 15
1 " " " 5 in. x 12 in. x 7 ft. 6 in.....	41 "	1 02	2 00	3 02
1 " " " 3 in. x 12 in. x 5 ft. 4 in.....	18 "	45	2 00	2 45
1 spring plank, channel, ½ in. x 13 in. x 4 in. x 7 ft..	255 lbs.	7 65	2 00	9 65
1 " " " ½ in. x 12 in. x 3 in. x 7 ft..	210 "	6 30	2 00	8 30
1 " " " ⅜ in. x 12 in. x 3 in. x 7 ft..	150 "	4 50	2 00	6 50
1 " " angle, ⅝ in. x 3 in. x 4 in. x 7 ft..	95 "	2 85	1 00	3 85
1 " " and 1 bolster in same truck	126 feet.	3 15	2 40	5 55
1 truck bolster truss rod, 1⅛ in. x 8 ft. 4 in.....	27 lbs.	81	20	1 01
1 " " " " 1 in. x 8 ft.....	21 "	63	20	83
1 " " " plate, 1 in. x 3 in. x 1 ft. 6 in.	15 "	45	10	55
1 " " " " 1 in. x 3 x 1 ft	10 "	30	10	40

REPAIRS TO FREIGHT TRUCKS.

ARCH BARS.

	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
1 arch bar, 1 inches x 3 inches x 6 feet 10 inches..	69 lbs.	$2 07	$0 60	$ 267
1 " " 1 " x 3 " x 6 " 4 " ..	64 "	1 92	60	2 52
1 " " 1⅛ " x 3 " x 6 " 4 " ..	72 "	2 16	60	2 76
1 " " 1¼ " x 3 " x 6 " 4 " ..	80 "	2 40	60	3 00
1 arch bar, 1 inches x 3½ inches x 6 feet 10 inches	80 "	2 40	60	3 00
1 " " 1 " x 3½ " x 6 " 4 "	74 "	2 22	60	2 82
1 " " 1⅛ " x 3½ " x 6 " 4 "	84 "	2 52	60	3 12
1 arch bar, 1 inches x 4 inches x 6 feet 10 inches	92 "	2 76	60	3 36
1 " " 1⅛ " x 4 " x 6 " 10 "	102 "	3 06	60	3 66
1 " " 1⅛ " x 4 " x 6 " 4 "	96 "	2 88	60	3 48
1 " " 1¼ " x 4 " x 6 " 4 "	107 "	3 21	60	3 81
1 or 2 arch bars on same side of truck:.....			60	60
Blacksmith labor repairing 1 arch bar.....			40	40
1 tie bar, ½ inch x 3 inches x 6 feet	30 "	90	10	1 00
1 " " ⅝ " x 3 " x 6 "	38 "	1 14	10	1 24
1 " " ½ " x 3½ " x 6 "	35 "	1 05	10	1 15
1 " " ⅝ " x 3½ " x 6 "	44 "	1 32	10	1 42
1 " " ½ " x 4 " x 6 "	40 "	1 20	10	1 30
1 " " ⅝ " x 4 " x 6 "	50 "	1 50	10	1 60
1 M. C. B. axle, 4¼ inch x 8 inch journal.....	465 "	9 50	50	10 00
1 M. C. B. " 4 " x 7 " "	385 "	7 50	50	8 00

NOTE.—Above prices do not include credit for scrap.
For scrap, credit ¾c per pound.

REPAIRS TO FREIGHT TRUCKS.

	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
1 oil box, 40,000 pounds capacity, cast iron	78 lbs.	$1 17	$0 40	$1 57
1 " " 60,000 " " "	90 "	1 35	40	1 75
1 " " 60,000 " " malleable iron	50 "	1 50	40	1 90
2 " " 60,000 " " on same axle	180 "	2 70	60	3 30
1 oil box cover, malleable		15	10	25
1 " " " pressed steel		15	10	25
1 oil box wedge, malleable	7 "	21	10	31
1 M. C. B. bearing, solid, 4¼ inches x 8 inches	12 "	1 32		1 32
1 " " " " " 4 " x 7 "	10 "	1 10		1 10
1 " " " " filled, 4¼ " x 8 "	12 "	96		96
1 " " " " " 4 " x 8 "	10 "	80		80
1 bolster spring, 7 inches high, Penn. W	60 "		40	
1 " " 6 " " " V	51 "		40	
1 column, double bolt, cast iron	70 "	1 05	40	1 45
1 " single " " "	20 "	30	40	70
1 " double " malleable	30 "	90	40	1 30
1 " single " "	18 "	54	40	94
1 column guide, double bolt, cast iron	22 "	33	20	53
1 " " single " " "	6 "	09	20	29
1 column bolt, 1 inch	6 "	18	40	58
1 or more column bolts replaced in same truck			40	
1 center plate, cast iron, average	72 "	1 08	60	1 68
1 " " malleable, "	35 "	1 05	60	1 65
1 or more center plate bolts, replaced			60	

REPAIRS TO FREIGHT TRUCKS.

	Amount of Material.	Cost of Mate'l.	Cost of Labor.	Total Cost.
1 side bearing, cast iron	17 lbs.	$0 25	$0 20	$0 45
1 " " malleable	10 "	30	20	50
1 transom end casting	140 "	2 10	2 00	4 10
1 channel bar end casting	79 "	1 19	3 00	4 19
1 " " " " malleable	70 "	2 10	3 00	5 10
1 brake head, cast iron, for wood beam	20 "	30	20	50
1 " " malleable " " "	9 "	27	20	47
1 " shoe, cast iron	20 "	30	10	40
1 brake hanger, $\frac{7}{8}$ inch loop outside brake	10 "	30	10	40
1 " " $\frac{7}{8}$ " " inside "	4 "	12	10	22
1 " " 1 " hook, outside "	6 "	18	10	28
1 " " 1 " " inside "	4 "	12	10	22
1 " " Y and hook, outside "	7 "	21	10	31
1 brake safety hanger, $\frac{1}{2}$ inch loop	5 "	15	10	25
1 bolster hanger, $\frac{3}{4}$ in. x 3 in. x 6 ft.	45 "	1 35	40	1 75
1 " " $\frac{3}{4}$ " x 3 " x 1 ft. 10 in.	17 "	51	20	71
1 " " $\frac{3}{4}$ " x $1\frac{1}{2}$ " x 1 ft. 10 in., loop	14 "	42	20	62
1 bolster hanger pin, $1\frac{1}{2}$ in. x 3 in. x 1 ft. 6 in.	20 "	60	20	80
1 " " " $1\frac{3}{4}$ in. x $1\frac{3}{4}$ in. x 1 ft. 8 in	18 "	54	20	74
1 " " " 2 in. rd. x 2 feet	21 "	63	20	83
1 metal brake beam, heads and shoes		3 50	40	3 90
1 wood " " trussed heads and shoes		3 24	40	3 64
1 " " " plain " " "		2 38	40	2 78
1 Bissell stop wedge, wrought iron	13 "	1 75	10	1 85
1 " " " cast steel	15 "	80	10	90

WHEELS AND AXLES.

Master Car Builders' Prices.

	New.	Second-Hand.	Scrap.
One 36-inch wheel	$ 8 00	$6 00	$4 00
One 33-inch wheel	6 50	5 00	3 00
One 30-inch wheel	5 50	3 00	2 50
One axle, 60,000 lbs. capacity	10 00	6 00	4 00
One axle, 40,000 lbs. or less	8 00	5 00	3 50

$1.50 additional for all labor for each pair of wheels and axles removed from truck.

PROPER CHARGES AND CREDITS, INCLUDING $1.50 EXTRA FOR LABOR.

CHARGE.	CREDIT.	Total Charge.
2 new 33 in. wheels, 1 new 60,000 lb. axle.	2 scrap wheels and scrap axle	$14 50
2 " 33 " " 1 " 60,000 " "	1 scrap and 1 second-hand wheel and scrap axle	12 50
2 " 33 " " 1 " 60,000 " "	2 scrap wheels and second-hand axle	12 50
2 " 33 " " 1 " 60,000 " "	1 scrap and 1 second-hand wheel and second-hand axle	10 50
2 " 33 " " 1 " 60,000 " "	2 second-hand wheels and scrap axle	10 50
2 " 33 " " 1 " 60,000 " "	2 second-hand wheels and second-hand axle	8 50
2 new 33 in. wheels, 1 second-hand 66,000 lb. axle.	2 scrap wheels and scrap axle	10 50
2 " 33 " " 1 " 60,000 " "	1 scrap and 1 second-hand wheel and scrap axle	8 50
2 " 33 " " 1 " 60,000 " "	2 scrap wheels and second-hand axle	8 50
2 " 33 " " 1 " 60,000 " "	1 scrap and 1 second-hand wheel, second-hand axle	6 50
2 " 33 " " 1 " 60,000 " "	2 second-hand wheels and scrap axle	6 50
2 " 33 " " 1 " 60,000 " "	2 second-hand wheels and second-hand axle	4 50

Charge for truing up 1 journal	$0 25
" " " " 2 "	50

WHEELS AND AXLES.

Master Car Builders' Prices.

CHARGE.	CREDIT.	Total Charge.
2 new 33 in. wheels, 1 new 40,000 lb. axle.	2 scrap wheels and scrap axle	$13 00
2 " 33 " " 1 " 40,000 " "	1 scrap and 1 second-hand wheel and scrap axle	11 00
2 " 33 " " 1 " 40,000 " "	2 scrap wheels and second-hand axle	11 50
2 " 33 " " 1 " 40,000 " "	1 scrap and second-hand wheel and second-hand axle	9 50
2 " 33 " " 1 " 40,000 " "	2 second-hand wheels and scrap axle	9 00
2 " 33 " " 1 " 40,000 " "	2 second-hand wheels and second-hand axle	7 50
2 new 33 in. wheels, 1 second-hand 40,000 lb. axle.	2 scrap wheels and scrap axle	10 00
2 " 33 " " 1 " 40,000 " "	1 scrap and 1 second-hand wheel and scrap axle	8 00
2 " 33 " " 1 " 40,000 " "	2 scrap wheels and second-hand axle	8 50
2 " 33 " " 1 " 40,000 " "	1 scrap and 1 second-hand wheel, second-hand axle	6 50
2 " 33 " " 1 " 40,000 " "	2 second-hand wheels and scrap axle	6 00
2 " 33 " " 1 " 40,000 " "	2 second-hand wheels and second-hand axle	4 50
2 new 33 in. wheels on same axle.	2 scrap wheels	8 50
2 " 33 " " " " "	1 scrap and 1 second-hand wheel	6 50
2 " 33 " " " " "	2 second-hand wheels	4 50
2 second-hand 33 in. wheels on same axle.	2 scrap wheels	5 50
2 " 33 " " " " "	1 scrap and 1 second-hand wheel	3 50
2 " 33 " " " " "	2 second-hand wheels	1 50

CONTRACT PRICES FOR LABOR.	New Work. Steel.	New Work. Iron.	Repair Work.
Turning axles ... each,	22 cents.	18 cents.	
Boring wheels ... per pair,	3 "	3 "	3 cents.
Pressing on wheels ... "	5 "	5 "	5 "
General labor, handling, etc.	5 "	4 "	4 "
Pressing off old wheels			5 "
Fitting up old axle			8 "
Total cost ... per pair,	35 "	30 "	25 "

SETTLEMENT PRICES FOR CARS DESTROYED.

Master Car Builders' Code of Rules.

The settlement prices of new eight-wheel cars, as follows, with an addition of $36.00 for each car equipped with air brakes.

BODIES—WOOD OR IRON.

Box car, eight wheel, 36 feet long or over, but under 40 feet	$325 00
" " " " 34 " " " " " 36 "	300 00
" " " " 32 " " " " " 34 "	275 00
" " " " under 32 feet long	240 00
Flat car, eight wheel, plain, 32 feet long or over	125 00
" " " " " under 32 feet long	100 00
Gondola, eight wheel, drop bottom, 30 tons or over	275 00
" " " " " 25 " "	250 00
" " " " " 20 " "	220 00
" " " " " 15 " or less	180 00
Gondola, eight wheel, hopper bottom, 30 tons or over	300 10
" " " " " 25 " "	275 00
" " " " " 20 " "	240 00
" " " " " 15 " "	200 00
Gondola, eight wheel, plain, 32 feet long or over	150 00
" " " " under 32 feet long	125 00
Stock car, eight wheel, 34 feet long or over	300 00
" " " " 32 feet long or over, but under 34 feet	275 00
" " " " under 32 feet long	240 00

Note.—The lengths of cars refer to the lengths over end sills.

When cars of 60,000 pounds capacity or over, and so stenciled, have trucks with journals 4 inches or over in diameter when new, $25.00 per car shall be added to the figures as given above for the values of car bodies.

SETTLEMENT PRICES FOR CARS DESTROYED.

Master Car Builders' Code of Rules.

TRUCKS.

With wood transoms, one pair, including brake beams complete, truck levers and connection rods	$200 00
With metal transoms, one pair, including brake beams complete, truck levers and connection rods	250 00

FOUR-WHEEL CARS.

Coal car, ordinary, complete	200 00
Box car, complete	230 00
Gondola car, drop bottom, complete	300 00

Rule 5, Sec. 20, M. C. B. Code, 1897.

Depreciation due to age shall be estimated at six per cent per annum upon the yearly depreciated value of the bodies and trucks only; provided, however, that allowances for depreciation shall in no case exceed sixty per cent of the value new.

The amount $36.00 for air brakes shall not be subject to any depreciation.

Rule 5, Sec. 21, M. C. B. Code, 1897.

Refrigerator cars, special stock cars and other freight cars, designed for special purposes not referred to above, shall be settled for at the present cost price, as may be agreed to by the parties in interest, less the depreciation due to age, which shall be on the same basis as for regular freight equipment.

SETTLEMENT PRICES FOR CARS DESTROYED.

TABLE SHOWING THE DEPRECIATED VALUE OF $100.00 AT SIX PER CENT.

Months.		1	2	3	4	5	6	7	8	9	10	11	
Years	.....	99.50	99.00	98.50	98.00	97.50	97.00	96.50	96.00	95.50	95.00	94.50	Years
1	94.00	93.53	93.06	92.59	92.12	91.65	91.18	90.71	90.24	89.77	89.30	88.83	1
2	88.36	87.92	87.48	87.03	86.59	86.15	85.71	85.27	84.83	84.38	83.94	83.50	2
3	83.06	82.64	82.23	81.81	81.40	80.98	80.57	80.15	79.74	79.32	78.91	78.49	3
4	78.07	77.69	77.30	76.91	76.52	76.13	75.73	75.34	74.95	74.56	74.17	73.78	4
5	73.40	73.03	72.66	72.29	71.92	71.56	71.19	70.82	70.45	70.09	69.72	69.36	5
6	68.99	68.65	68.30	67.95	67.61	67.27	66.92	66.58	66.23	65.89	65.54	65.20	6
7	64.85	64.53	64.20	63.88	63.55	63.23	62.91	62.58	62.26	61.93	61.61	61.28	7
8	60.96	60.66	60.35	60.05	59.74	59.43	59.13	58.82	58.52	58.22	57.91	57.61	8
9	57.30	57.01	56.73	66.44	56.15	55.87	55.58	55.30	55.05	54.72	54.43	54.15	9
10	53.86	53.59	53.33	53.07	52.79	52.52	52.25	51.68	51.71	51.44	51.17	50.90	10
11	50.63	50.38	50.13	49.87	49.62	49.37	49.11	48.86	48.61	48.35	48.10	47.85	11
12	47.60	47.36	47.12	46.88	46.64	46.40	46.17	45.93	45.69	45.45	45.21	44.98	12
13	44.74	44.51	44.29	44.07	43.84	43.62	43.40	43.17	42.95	42.72	42.50	42.28	13
14	42.06	41.84	41.63	41.42	41.21	41.00	40.79	40.58	40.37	40.16	39.95	.....	14
Months.		1	2	3	4	5	6	7	8	9	10	11	

To ascertain the depreciated value of a car, multiply the amount shown in the table for the age of the car, by the original value of the car, and point off four places of decimals.

EXAMPLE.

Age of car, 12 years 9 months. Original value, $300.00.
Depreciation for 12 years 9 months (as per table), $45.45.
$45.45 X 300 = 13635.00; move decimal point = $136.35.
Depreciated value, $136.35.

STANDARD M. C. B. COUPLERS.

WEIGHTS AND PRICES.

Name of Coupler.	Material.		Weight.		M. C. B. Prices, 1897.		
	Coupler.	Knuckle.	Coupler.	Knuckle.	Complete	Skeleton	Knuckle.
American	Steel	Steel	161 lbs	52 lbs.	$11 00	$6 75	$3 00
Buckeye	Mall.	"	156 "	49 "	9 00	6 00	2 50
California	Steel	"	168 "	33 "	11 25	7 00	3 50
Chicago	"	"	154 "	50 "	11 00	7 50	3 50
Drexel	"	"	143 "	52 "	10 50	5 50	4 00
Gould	Mall.	"	159 "	37 "	12 50	8 35	2 80
Hinson	"	"	156 "	55 "	10 00	6 00	3 50
Janney	"	Wro't & Steel	175 "	36 "	10 00	6 25	3 25
Mo. Pacific	Steel	Steel	170 "	50 "	9 00	5 50	2 50
S. H. & H	"	"	147 "	50 "	10 00	6 50	3 50
Standard	Mall.	"	142 "	66 "	12 50	7 25	4 25
St. Louis	Steel	"	143 "	53 "	10 25	5 75	4 00
Thurmond	Mall.	"	154 "	48 "	10 00	6 00	2 50
Tower	"	"	156 "	48 "	9 75	6 00	3 00
Trojan	"	"	159 "	53 "	12 50	7 25	4 00

The Buckeye and Janney couplers, Buckeye steel knuckles, and Janney wrought iron knuckles will be replaced as follows: Couplers (skeleton), $4.00 each. Knuckles, $1.00 each.

Rule 5, Sec. 11, M. C. B. Code, 1897.

M. C. B. couplers, or parts of same, to be charged at manufacturer's current market prices, or replacement prices, which are to be quoted by the secretary September 1 and March 1 of each year.

When the coupler manufacturers do not quote a replacement price, and do not require the return of the scrap for the price quoted, the credit for scrap shall be allowed at the rates given in M. C. B. schedule of prices and credits, Rule 5, Section 10.

USEFUL INFORMATION.

Tables of Weights and Measures.

Weights of Bar, Plate and Sheet Iron, Galvanized Iron and Tin, Bolts, Nuts, Nails and Tacks.

Capacities of Tanks and Cisterns.

Weights of Logs, Lumber and Various Substances.

Weights, Sizes and Capacities of Helical Springs.

Areas and Circumferences of Circles.

Tables of Board Measure, Etc.

Detail Bills of Material of Freight Cars.

WEIGHTS AND MEASURES.

TROY WEIGHT.

Pounds.	Ounces.	Pennyweights.	Grains.
1.	12.	240.	5760.
0.08333	1.	20.	480.
	0.05	1.	24.
		0.0416	1.

Troy weight is used for weighing gold and silver.

The grain is the same in Avoirdupois, Troy and Apothecaries' weights.

A carat, used in weighing diamonds = 3.168 grains.

APOTHECARIES' WEIGHT.

Pounds.	Ounces.	Drachms.	Scruples.	Grains.
1.	12.	96.	288.	5760.
0.08333	1.	8.	24.	480.
	0.0125	1.	3.	60.
		0.0333	1.	20.
			0.05	1.

APOTHECARIES' FLUID MEASURE.

60 minims = 1 fluid drachm.

8 drachms or 437.5 grains or 1.732 cubic inches = 1 fluid ounce.

12 ounces = 1 fluid pint.

WEIGHTS AND MEASURES.

AVOIRDUPOIS OR ORDINARY COMMERCIAL WEIGHT.

Tons.	Cwts.	Pounds.	Ounces.
1.	20.	2240.	35840.
0.050	1.	112.	1792.
	0.0089	1.	16.
		0.0625	1.

16 drachms or 437.5 grains = 1 ounce.

1 pound = 27.7 cubic inches of distilled water at its maximum density (39° Fahrenheit).

A stone is 14 pounds; a quintal is 100 pounds.

LONG MEASURE.

Miles.	Rods.	Yards.	Feet.	Inches.
1.	320.	1760.	5280.	63360.
0.003125	1.	5.	16.5	198.
0.000568	0.1818	1.1	3.	36.
0.0001894	0.0606	0.3333	1.	12.
0.0000158	0.005051	0.02778	0.08333	1.

The British measures are shorter than those of the United States by about 1 part in 17230 or 3.677 inches in a mile.

A palm is 3 inches.

A hand is 4 inches.

A span is $10\frac{1}{8}$ inches.

A fathom is 6 feet.

A cable's length is 120 fathoms.

A gunter's or surveyor's chain is 66 feet or 4 rods long, and is divided into 100 links of 7.92 inches in length; 80 chains making a mile.

WEIGHTS AND MEASURES.

SQUARE OR LAND MEASURE.

Sq. Miles.	Acres.	Sq. Rods.	Sq. Yards.	Sq. Feet.	Sq. Inches.
1.	640.	102400.	3097600.	27878400.	
	1.	160.	4840.	43560.	6272640.
		1.	30.25	272.25	39204.
		0.0331	1.	9.	1296.
			0.111	1.	144.
				0.00694	1.

Acres × .0015625 = square miles.
Square yards × .000000325 = square miles.
Acres × .4840 = square yards.
Square yards × .0002066 = acres.

A section of land is 1 mile square and contains 640 acres.
A square acre is 208.71 feet at each side; or 220 x 198 feet.
A square ½ acre is 147.58 feet at each side; or 110 x 198 feet.
A square ¼ acre is 104.355 feet at each side; or 55 x 198 feet.

LIQUID MEASURE.

This measure is founded on the old British wine gallon which contains 231 cubic inches of distilled water at a temperature of 39.85° Fahrenheit.

4 gills = 1 pint.
2 pints = 1 quart.
4 quarts = 1 gallon.
31½ gallons = 1 barrel.
2 barrels = 1 hogshead.
2 hogsheads = 1 pipe or butt.
2 pipes = 1 tun.
A puncheon is 84 gallons.
A tierce is 42 gallons.

WEIGHTS AND MEASURES.

DRY MEASURE.

UNITED STATES ONLY.

Struck Bush.	Pecks.	Gallons.	Quarts.	Pints.	Cubic Inches.
1.	4.	8.	32.	64.	2150.
	1.	2.	8.	16.	537.6
		0.25	1.	2.	67.2
		0.125	0.5	1.	33.6
		1.	4.	8.	268.8

A gallon of liquid measure = 231 cubic inches.

A heaped bushel = 1¼ struck bushels.

The cone in a heaped bushel must be not less than 6 inches high.

A struck bushel = 1.2445 cubic feet.

A barrel of United States hydraulic cement = 300 to 310 lbs. usually.

A barrel of genuine Portland cement = 425 lbs.

To reduce United States dry measure to British imperial, divide by 1.032.

CUBIC OR SOLID MEASURE.

1728 cubic inches = 1 cubic foot. 27 cubic feet = 1 cubic yard.

A cord of wood = 4 feet × 4 feet × 8 feet = 128 cubic feet.

A perch of masony = 16.5 feet × 1.5 feet × 1 foot = 24.75 cubic feet, but is generally assumed to be 25 cubic feet.

NAUTICAL MEASURE.

A nautical or sea mile (a knot) is the length of a minute of longitude of the earth at the equator at the level of the sea. It is assumed = 6086.07 feet or 1.152664 statute or land miles by the United States Coast Survey.

3 nautical miles = 1 league.

WEIGHTS AND MEASURES.

MEASURES OF LENGTH.

French.	British.			
	Inches.	Feet.	Yards.	Miles.
Millimetre.	.039368	.00328		
Centimetre.	.39368	.03280		
Decimetre.	3.9368	.32807	.109357	
Metre.	39.368	3.2807	1.09357	
Decametre.	393.68	32.807	10.9357	
Hectometre.		328.07	109.357	.0621346
Kilometre.		3280.7	1093.57	.621346
Myriametre.		32807.	10935.7	6.21346

U. S.	French.	U. S.	French.
1 inch =	.0254 metres.	1 yard =	.9144 metres.
1 foot =	.30479 "	1 mile =	160.931 "

Circumference of a circle = diameter × 3.1416.
Diameter of a circle = circumference × 0.3183.
Side of square of equal periphery as circle = diameter × 0.7854.
Diameter of circle of equal periphery as square = side × 1.2732.
Side of an inscribed square = diameter of circle × 0.7071.
Length of arc = number of degrees × diameter × 0.008727.

CAPACITY OF BOXES.

4 inches	x	4 inches	x	4½ inches	=	1 quart.
8 "	x	8 "	x	8½ "	=	1 peck.
8 "	x	15½ "	x	26 "	=	1 bushel.
16 "	x	24 "	x	28 "	=	1 barrel.

USEFUL MULTIPLIERS FOR RAPID APPROXIMATION.

Feet,	×	.00019	= miles.
Yards,	×	.0006	= miles.
Square inches,	×	.007	= square feet.
Square feet,	×	.111	= square yards.
Cubic feet,	×	.04	= cubic yards.
Cubic inches,	×	.00058	= cubic feet.
Cubic feet,	×	.8036	= U. S. bushels.
U. S. bushels,	×	1.2446	= cubic feet.
U. S. gallons,	×	.13367	= cubic feet.
U. S. gallons,	×	231.	= cubic inches.
Cubic feet,	×	7.48	= U. S. gallons.
Cubic inches,	×	.004329	= U. S. gallons.
Pounds,	×	.009	= cwt.
Pounds,	×	.00045	= tons.
Cubic feet of water,	×	62.5	= lbs. avoir.
Cubic inches of water,	×	.03617	= lbs. avoir.

MENSURATION OF SURFACES,

Area of circle = diameter^2 × .7854.
Area of triangle = base × ½ perpendicular.
Surface of a sphere = diameter^2 + 3.1416.

MENSURATION OF SOLIDS.

Cylinder = area of end × length.
Sphere = diameter^2 × 0.5236.
Wedge = area of base × ½ perpendicular.

To find the radius, when the length of the arc and rise are given, square one-half the arc and divide by the rise, add the rise and divide by two. Example—Length of arc 8 inches, rise 2 inches. $4^2 = 16 \div 2 = 8 + 2 = 10 \div 2 = 5$ inches radius.

CAPACITY OF CISTERNS IN GALLONS.

FOR EACH FOOT IN DEPTH.

1 foot	diameter	=	6 gallons.	11 feet	diameter	=	711 gallons.
2 feet	"	=	23 "	12 "	"	=	846 "
3 "	"	=	53 "	13 "	"	=	993 "
4 "	"	=	94 "	14 "	"	=	1151 "
5 "	"	=	147 "	15 "	"	=	1322 "
6 "	"	=	211 "	16 "	"	=	1504 "
7 "	"	=	288 "	17 "	"	=	1698 "
8 "	"	=	376 "	18 "	"	=	1904 "
9 "	"	=	476 "	19 "	"	=	2121 "
10 "	"	=	587 "	20 "	"	=	2350 "

WEIGHTS AND SPECIFIC GRAVITIES OF LIQUIDS.

Liquids at 32° Fahrenheit.	Weight of 1 Cubic Foot.	Weight of 1 Gallon.	Specific Gravity Water = 1.
	Pounds.	Pounds.	
Mercury	848.7	136.0	13.596
Sulphuric acid, maximum	114.9	18.4	1.84
Pure water (distilled) at 39° Fahr	62.425	10.0	1.00
Sea water, ordinary	64.05	10.3	1.026
Water of the Dead Sea	77.4	12.4	1.24
Nitric acid of commerce	76.2	12.2	1.22
Milk	64.3	10.3	1.08
Linseed oil	58.7	9.4	0.94
Whale oil	57.4	9.2	0.92
Olive oil	57.1	9.15	0.915
Turpentine	54.3	8.7	0.87
Petroleum	54.9	8.8	0.88
Naphtha	53.1	8.5	0.85
Alcohol, proof spirit	57.4	9.2	0.92
Alcohol, pure	49.3	7.9	0.79
Benzine	53.1	8.5	0.85
Wood spirit	49.9	8.0	0.80
Ether, sulphuric	44.9	7.2	0.72

SPACE OCCUPIED BY ONE TON OF 2240 POUNDS.

	Cubic Feet.
Corn, on cob	80
Corn, shelled	50
Wheat	46
Rye	50
Barley	58
Oats	86
Hay	512
Coal, anthracite, broken lumps	42
Coal, bituminous, broken lumps	46
Coke	73
Charcoal, average	123
Lime, broken lumps	38
Salt, coarse	35
Brick, pressed, piled	15
Brick, common, piled	20
Sand, dry	23
Sand, wet	18
Clay, wet	17
Mud, wet	17
Earth, dry	27
Earth in bank	18
Masonry, granite laid in mortar	14
Masonry, medium quality	18
Limestone	23
Quartz	20

WEIGHT OF LUMBER PER 1000 FEET, BOARD MEASURE.

	Gross Tons.
Ash, American white, dry	1.41
Black walnut, "	1.41
Cherry, "	1.56
Chestnut, "	1.53
Elm, "	1.30
Hemlock, "	.93
Hickory, "	1.97
Maple, "	1.82
Mahogany, Spanish, "	1.97
Mahogany, Honduras, "	1.30
Oak, live, "	2.21
Oak, white, "	1.79
Oak, red, "	1.41
Pine, white, "	.93
Pine, Norway, "	1.28
Fine, Southern yellow, "	1.67
Pine, long leaf heart, not seasoned	2.42
Spruce, dry	.93
Sycamore, "	1.38

NOTE.—Green timber runs from $\frac{1}{4}$ to $\frac{1}{2}$ more in weight than dry. Ordinary building timber, tolerably seasoned, $\frac{1}{6}$ more than dry.

WEIGHTS OF LOGS, LUMBER, ETC.

WEIGHT OF GREEN LOGS TO SCALE 1000 FEET, BOARD MEASURE.

Yellow pine (Southern)		8000 to 10000 lbs.
Norway pine (Michigan)		7000 to 8000 lbs.
White pine (Michigan)	off of stump	6000 to 7000 lbs.
	out of water	7000 to 8000 lbs.
White pine (Pennsylvania), bark off		5000 to 6000 lbs.
Hemlock (Pennsylvania), bark off		6000 to 7000 lbs.

Four acres of water are required to store 1,000,000 feet of logs.

WEIGHT PER BUSHEL AND PER CUBIC FOOT.

	Weight per Bushel.	Weight per Cubic Foot.
Bran	20 lbs.	16 lbs.
Barley	48 "	39 "
Buckwheat	48 "	39 "
Cornmeal	48 "	39 "
Corn, shelled	56 "	45 "
Corn on cob	35 "	28 "
Oats	32 "	26 "
Rye	56 "	45 "
Wheat	60 "	48 "
Beans	60 "	48 "
Peas	60 "	48 "
Turnips	55 "	44 "
Potatoes	60 "	48 "
Sweet potatoes	55 "	44 "
Onions	57 "	46 "
Clover seed	60 "	48 "
Timothy seed	45 "	36 "
Flax "	56 "	45 "
Hemp "	44 "	36 "
Malt	38 "	30 "
Salt, coarse	78 "	63 "
Lime, broken lumps	75 "	60 "
Cement	66 "	53 "

One heaped bushel = 1¼ struck bushels.
One struck bushel = 1.24445 cubic feet.
One cubic foot = .8036 of a struck bushel.

WEIGHTS OF VARIOUS SUBSTANCES.

PER CUBIC FOOT.

	Pounds.
Aluminum	162
Anthracite, solid, of Pennsylvania	93
" broken, loose	54
" " moderately shaken	58
" heaped bushel, loose	(80)
Ash, American white, dry	38
Asphaltum	87
Brass (copper and zinc), cast	504
" rolled	524
Brick, best pressed	150
" common hard	125
" soft, inferior	100
Brickwork, pressed brick	140
" ordinary	112
Cement, hydraulic, ground, loose. American, Rosendale	56
" " " " " Louisville	50
" " " " English, Portland	90
Cherry, dry	42
Chestnut, dry	41
Coal, bituminous, solid	84
" " broken, loose	49
" " heaped bushel, loose	(74)
Coke, loose, of good coal	27
" " heaped bushel	(38)
Copper, cast	542
" rolled	548

WEIGHTS OF VARIOUS SUBSTANCES.

PER CUBIC FOOT.

	Pounds.
Earth, common loam, dry, loose	76
" " " moderately rammed	95
" as a soft flowing mud	108
Ebony, dry	76
Elm, dry	35
Flint	162
Glass, common window	157
Gneiss, common	168
Gold, cast, pure, or 24 carat	1204
" pure hammered	1217
Granite	170
Gravel, about the same as sand.	
Gypsum (plaster-of-paris)	142
Hemlock, dry	25
Hickory, dry	53
Hornblende, black	203
Ice	58.7
Iron, cast	450
" wrought, purest	485
" " average	480
Ivory	114
Lead	·711
Lignum-vitæ, dry	83
Lime, quick, ground, loose or in small lumps	53
" " " " thoroughly shaken	75
" " " " per struck bushel	(66)

WEIGHTS OF VARIOUS SUBSTANCES.

PER CUBIC FOOT.

	Pounds.
Limestones and marbles	168
" " " loose, in irregular fragments	96
Magnesium	109
Mahogany, Spanish, dry	53
" Honduras, dry	35
Maple, dry	49
Masonry of granite or limestone, well dressed	165
" of mortar rubble	154
" of dry rubble (well scabbled)	138
" of sandstone, well dressed	144
Mercury, at 32° Fahrenheit	849
Mica	183
Mortar, hardened	103
Mud, dry close	80 to 110
" wet, fluid, maximum	120
Oak, live, dry	59
" white, dry	52
" other kinds	32 to 45
Petroleum	55
Pine, white, dry	25
" yellow, northern	34
" " southern	45
Platinum	1342
Quartz, common, pure	165

WEIGHTS OF VARIOUS SUBSTANCES.

PER CUBIC FOOT.

	Pounds.
Rosin	69
Salt, coarse, Syracuse, N. Y.	45
" Liverpool, fine, for table use	49
Sand, of pure quartz, dry loose	90 to 106
" well shaken	99 to 117
" perfectly wet	120 to 140
Sandstone, fit for building	151
Shales, red or black	162
Silver	655
Slate	175
Snow, freshly fallen	5 to 12
" moistened and compacted by rain	15 to 50
Spruce, dry	25
Steel	490
Sulphur	125
Sycamore, dry	37
Tar	62
Tin, cast	459
Turf or peat, dry, unpressed	20 to 30
Walnut, black, dry	38
Water, pure rain or distilled at 60° Fahr.	62½
" sea	64
Wax, bees	60.5
Zinc or spelter	437

GENERAL RULES FOR DETERMINING WEIGHT OF ANY PIECE OF WROUGHT IRON.

One cubic foot of wrought iron =			480 lbs.
One square foot, one inch thick =	$\frac{480}{12}$	=	40 lbs.
One square inch, one foot long =	$\frac{40}{12}$	=	$3\frac{1}{3}$ lbs.
One square inch, one yard long =	$3\frac{1}{3} \times 3$	=	10 lbs.

Hence, the weight of any piece of wrought iron in pounds per yard is equal to 10 times its area in square inches.

EXAMPLE.—The area of a bar 3 inches x 1 inch = 3 square inches, and its weight is 30 lbs. per yard.

For round iron, the weight per foot may be found by taking the diameter in quarter inches, squaring it, and dividing by 6.

EXAMPLE.—What is the weight of 2-inch round iron? 2 inches = 8 quarter inches; $8^2 = 64$; $\frac{64}{6} = 10\frac{2}{3}$ lbs. per foot.

EXAMPLE.—What is the weight of $\frac{3}{4}$-inch round iron? $\frac{3}{4}$-inch = 3 quarter inches; $3^2 = 9$; $\frac{9}{6} = 1\frac{1}{2}$ lbs. per foot.

TO FIND THE WEIGHT OF CASTINGS BY THE WEIGHT OF PINE PATTERNS.

Multiply the weight of the pattern by 16 for cast iron, 13 for brass, 19 for lead, 12.2 for tin, 14.4 for zinc, and the product is the weight of the casting.

SHRINKAGE OF CASTINGS.

Pattern makers' rule should be for:

Cast iron,	$\frac{1}{8}$	inch	longer	per	foot.
Brass,	$\frac{3}{16}$	"	"	"	"
Lead,	$\frac{1}{8}$	"	"	"	"
Tin,	$\frac{1}{2}$	"	"	"	"
Zinc,	$\frac{3}{16}$	"	"	"	"

FLAT BAR IRON.

WEIGHT PER LINEAL FOOT.

Width in Inches.	Thickness in Inches.												
	1-16	⅛	3-16	¼	⅜	½	⅝	¾	⅞	1	1¼	1½	2
1	.21	.42	.63	.84	1.26	1.68	2.11	2.53	2.95	3.37	4.25	5.10	6.80
1¼	.26	.53	.79	1.05	1.58	2.11	2.63	3.16	3.68	4.21	5.31	6.38	8.50
1½	.32	.63	.95	1.26	1.90	2.53	3.16	3.79	4.42	5.05	6.38	7.65	10.20
1¾	.37	.74	1.11	1.47	2.21	2.95	3.68	4.42	5.16	5.89	7.44	8.93	11.90
2	.42	.84	1.26	1.68	2.53	3.37	4.21	5.05	5.89	6.74	8.50	10.20	13.60
2¼	.47	.95	1.42	1.90	2.84	3.79	4.74	5.68	6.83	7.58	9.57	11.48	15.30
2½	.53	1.05	1.58	2.11	3.16	4.21	5.26	6.32	7.37	8.42	10.63	12.75	17.00
2¾	.58	1.16	1.74	2.32	3.47	4.63	5.79	6.95	8.10	9.26	11.69	14.03	18.70
3	.63	1.26	1.90	2.53	3.79	5.05	6.32	7.58	8.84	10.10	12.75	15.30	20.40
3¼	.68	1.37	2.05	2.74	4.11	5.47	6.84	8.21	9.58	10.95	13.81	16.58	22.10
3½	.74	1.47	2.21	2.95	4.42	5.89	7.37	8.84	10.32	11.79	14.87	17.85	23.80
3¾	.79	1.58	2.37	3.16	4.74	6.32	7.89	9.47	11.05	12.63	15.94	19.13	25.50
4	.84	1.68	2.53	3.37	5.05	6.74	8.42	10.10	11.79	13.47	17.00	20.40	27.20
4¼	.90	1.79	2.68	3.58	5.37	7.16	8.65	10.74	12.53	14.31	18.06	21.68	28.90
4½	.95	1.90	2.84	3.79	5.68	7.58	9.47	11.38	13.26	15.16	19.13	22.95	30.60
4¾	1.00	2.00	3.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	20.00	24.00	32.00
5	1.05	2.11	3.16	4.21	6.32	8.42	10.53	12.63	14.74	16.84	21.25	25.50	34.00
5¼	1.11	2.21	3.32	4.42	6.63	8.84	11.05	13.26	15.47	17.68	22.32	26.78	35.70
5½	1.16	2.32	3.47	4.63	6.95	9.26	11.58	13.89	16.21	18.52	23.38	28.05	37.40
5¾	1.21	2.42	3.63	4.84	7.26	9.68	12.10	14.53	16.95	19.37	24.44	29.33	39.10
6	1.26	2.53	3.79	5.05	7.58	10.10	12.63	15.16	17.68	20.21	25.50	30.60	40.80
6½	1.38	2.76	4.14	5.53	8.29	11.05	13.81	16.58	19.34	22.10	27.62	33.15	44.20
7	1.48	2.97	4.46	5.95	8.93	11.90	14.87	17.85	20.83	23.80	29.75	35.70	47.60
7½	1.59	3.18	4.78	6.36	9.57	12.75	15.94	19.13	22.32	25.50	31.88	38.26	51.00
8	1.70	3.41	5.10	6.80	10.20	13.60	17.00	20.40	23.80	27.20	34.00	40.80	54.40

ROUND AND SQUARE IRON.

WEIGHT PER LINEAL FOOT FROM $\frac{1}{4}$ TO 8 INCH.

Size.	Round.	Square.	Size.	Round.	Square.
In Inches.	Weight in Pounds.	Weight in Pounds.	In Inches.	Weight in Pounds.	Weight in Pounds.
$\frac{1}{4}$	.167	.212	$2\frac{1}{2}$	16.69	21.25
$\frac{5}{16}$	.261	.333	$2\frac{5}{8}$	18.40	23.43
$\frac{3}{8}$	.375	.478	$2\frac{3}{4}$	20.20	25.00
$\frac{7}{16}$	.511	.651	$2\frac{7}{8}$	22.07	28.10
$\frac{1}{2}$	.667	.850	3	24.03	30.60
$\frac{5}{8}$	1.043	1.328	$3\frac{1}{4}$	28.20	35.92
$\frac{3}{4}$	1.502	1.913	$3\frac{1}{2}$	32.71	41.65
$\frac{7}{8}$	2.044	2.603	$3\frac{3}{4}$	37.56	47.82
1	2.670	3.400	4	42.73	54.40
$1\frac{1}{8}$	3.379	4.303	$4\frac{1}{4}$	48.24	61.41
$1\frac{1}{4}$	4.173	5.312	$4\frac{1}{2}$	54.07	68.85
$1\frac{3}{8}$	5.049	6.428	$4\frac{3}{4}$	60.25	76.71
$1\frac{1}{2}$	6.008	7.650	5	66.76	85.00
$1\frac{5}{8}$	7.051	8.978	$5\frac{1}{4}$	73.60	93.72
$1\frac{3}{4}$	8.178	10.41	$5\frac{1}{2}$	80.77	102.8
$1\frac{7}{8}$	9.388	11.95	$5\frac{3}{4}$	88.29	112.4
2	10.68	13.60	6	96.14	122.4
$2\frac{1}{8}$	12.06	15.35	$6\frac{1}{2}$	112.8	143.6
$2\frac{1}{4}$	13.52	17.22	7	130.9	166.6
$2\frac{3}{8}$	15.07	19.18	$7\frac{1}{2}$	150.2	191.3
			8	171.0	217.6

PLATE IRON.

WEIGHT PER SQUARE FOOT.

Thickness in Inches.	Weight in Pounds.	Thickness in Inches.	Weight in Pounds.
$\frac{1}{32}$	1.25	$\frac{3}{8}$	15.10
$\frac{1}{16}$	2.519	$\frac{7}{16}$	17.65
$\frac{3}{32}$	3.788	$\frac{1}{2}$	20.20
$\frac{1}{8}$	5.054	$\frac{9}{16}$	22.76
$\frac{5}{32}$	6.305	$\frac{5}{8}$	25.16
$\frac{3}{16}$	7.578	$\frac{3}{4}$	30.20
$\frac{1}{4}$	10.09	$\frac{7}{8}$	35.30
$\frac{5}{16}$	12.58	1	40.40

METALS.

WEIGHT PER SQUARE FOOT.

Thickness.	Wrot Iron.	Cast Iron.	Steel.	Copper.	Brass.	Lead.	Zinc.
$\frac{1}{16}$	2.51	2.34	2.55	2.89	2.67	3.69	2.34
$\frac{1}{8}$	5.03	4.69	5.10	5.78	5.35	7.38	4.68
$\frac{3}{16}$	7.58	7.03	7.66	8.67	8.02	11.07	7.02
$\frac{1}{4}$	10.07	9.38	10.21	11.56	10.70	14.76	9.36
$\frac{5}{16}$	12.58	11.73	12.76	14.45	13.37	18.45	11.70
$\frac{3}{8}$	15.10	14.07	15.31	17.34	16.05	22.14	14.04
$\frac{7}{16}$	17.62	16.42	17.87	20.23	18.72	25.83	16.34
$\frac{1}{2}$	20.14	18.77	20.42	23.12	21.40	29.53	18.72
$\frac{9}{16}$	22.65	21.11	22.97	26.01	24.07	33.22	21.08
$\frac{5}{8}$	25.17	23.46	25.52	28.90	26.75	36.91	23.44
$\frac{11}{16}$	27.69	25.81	28.08	31.97	29.42	40.60	25.80
$\frac{3}{4}$	30.21	28.15	30.63	34.68	32.10	44.29	28.13
$\frac{13}{16}$	32.72	30.50	33.18	37.57	35.19	47.98	30.49
$\frac{7}{8}$	35.24	32.85	35.73	40.69	38.28	51.67	32.81
$\frac{15}{16}$	37.76	35.19	38.28	43.35	41.37	55.37	35.17
1	40.28	37.54	40.83	46.25	43.75	59.06	37.50

WEIGHT OF SHEETS OF WROUGHT IRON, STEEL, COPPER AND BRASS.

(HASWELL.)

WEIGHT PER SQUARE FOOT. THICKNESS BY BIRMINGHAM GAUGE.

Number of Gauge.	Thickness in Inches.	Iron.	Steel.	Copper.	Brass.
0000	.454	18.22	18.46	20.57	19.43
000	.425	17.05	17.28	19.25	18.19
00	.38	15.25	15.45	17.21	16.26
0	.34	13.64	13.82	15.40	14.55
1	.3	12.04	12.20	13.59	12.84
2	.284	11.40	11.55	12.87	12.16
3	.259	10.39	10.53	11.73	11.09
4	.238	9.55	9.68	10.78	10.19
5	.22	8.83	8.95	9.97	9.42
6	.203	8.15	8.25	9.20	8.69
7	.18	7.22	7.32	8.15	7.70
8	.165	6.62	6.71	7.47	7.06
9	.148	5.94	6.02	6.70	6.33
10	.134	5.38	5.45	6.07	5.74
11	.12	4.82	4.88	5.44	5.14
12	.109	4.37	4.43	4.94	4.67
13	.095	3.81	3.86	4.30	4.07
14	.083	3.33	3.37	3.76	3.55
15	.072	2.89	2.93	3.26	3.08
16	.065	2.61	2.64	2.94	2.78
17	.058	2.33	2.36	2.63	2.48
18	.049	1.97	1.99	2.22	2.10
19	.042	1.69	1.71	1.90	1.80
20	.035	1.40	1.42	1.59	1.50

WEIGHT OF SHEETS OF WROUGHT IRON, STEEL, COPPER AND BRASS.

(HASWELL.)

Number of Gauge.	Thickness in Inches.	Weight per Square Foot. Iron.	Steel.	Copper.	Brass.
21	.032	1.28	1.30	1.45	1.37
22	.028	1.12	1.14	1.27	1.20
23	.025	1.00	1.02	1.13	1.07
24	.022	.883	.895	1.00	.942
25	.02	.803	.813	.906	.856
26	.018	.722	.732	.815	.770
27	.016	.642	.651	.725	.685
28	.014	.562	.569	.634	.599
29	.013	.522	.529	.589	.556
30	.012	.482	.488	.544	.514
31	.01	.401	.407	.453	.428
32	.009	.361	.366	.408	.385
33	.008	.321	.325	.362	.342
34	.007	.281	.285	.317	.300
35	.005	.201	.203	.227	.214
Specific gravity		7.704	7.806	8.698	8.218
Weight, cubic foot		481.25	487.75	543.6	513.6
" " inch		.2787	.2823	.3146	.2972

As there are many gauges in use differing from each other, and even the thicknesses of a certain specified gauge, as the Birmingham, are not assumed the same by all manufacturers, orders for sheets should always state the weight per square foot, or thickness in thousandths of an inch.

WEIGHT OF 100 BOLTS WITH SQUARE HEADS AND NUTS.

	Diameter of Bolts.								
Length Under Head.	¼ in.	5-16 in.	⅜ in.	7-16 in.	½ in.	⅝ in.	¾ in.	⅞ in.	1 in.
1½ inches	4.0	7.0	10.5	15.2	22.5	39.5	63.0		
1¾ "	4.4	7.5	11.3	16.3	23.8	41.6	66.0		
2 inches	4.8	8.0	12.0	17.4	25.2	43.8	69.0	109.0	163.
2¼ "	5.2	8.5	12.8	18.5	26.5	45.8	72.0	113.3	169.
2½ "	5.5	9.0	13.5	19.6	27.8	48.0	75.0	117.5	174.
2¾ "	5.8	9.5	14.3	20.7	29.1	50.1	78.0	121.8	180.
3 inches	6.3	10.0	15.0	21.8	30.5	52.3	81.0	126.0	185.
3½ "	7.0	11.0	16.5	24.0	33.1	56.5	87.0	134.3	196.
4 "	7.8	12.0	18.0	26.2	35.8	60.8	93.1	142.5	207.
4½ "	8.5	13.0	19.5	28.4	38.4	65.0	99.1	151.0	218.
5 inches	9.3	14.0	21.0	30.6	41.1	69.3	105.2	159.6	229.
5½ "	10.0	15.0	22.5	32.8	43.7	73.5	111.3	168.0	240.
6 "	10.8	16.0	24.0	35.0	46.4	77.8	117.3	176.6	251.
6½ "	11.5	17.0	25.5	37.2	49.0	82.0	123.4	185.0	262.
7 inches			27.0	39.4	51.7	86.3	129.4	193.7	273.
7½ "			28.5	41.6	54.3	90.5	135.0	202.0	284.
8 "			30.0	43.8	59.6	94.8	141.5	210.7	295.
9 "			33.1	48.2	64.9	103.3	153.6	227.8	317.
10 inches				52.6	70.2	111.8	165.7	244.8	339.
11 "				56.8	75.5	120.3	177.8	261.9	360.
12 "				61.0	80.8	123.8	189.9	278.9	382.
13 "				65.2	86.1	137.3	202.0	296.0	404.
14 inches					91.4	145.8	214.1	313.0	426.
15 "					96.7	154.3	226.2	330.1	448.
16 "					102.0	162.8	238.3	347.1	470.
Per inch, additional.	1.4	2.1	3.1	4.2	5.5	8.5	12.3	16.7	21.8

WEIGHTS OF NUTS AND BOLT HEADS IN POUNDS.

FOR CALCULATING THE WEIGHT OF LONG BOLTS.

Diameter of bolt, inches		$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$
Weight of hex. head and nut		.017	.057	.128	.267	.48	.73
" " square " " "		.021	.069	.164	.320	.53	.88
Diameter of bolt, inches	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2	$2\frac{1}{2}$	3
Weight of hex. head and nut	1.10	2.14	3.78	5.6	8.75	17.	28.8
" " square " " "	1.31	2.56	4.42	7.0	10.5	21.	36.4

UNITED STATES STANDARD NUMBER OF THREADS TO AN INCH.

Diameter	$\frac{1}{4}$ in.	$\frac{5}{16}$ in.	$\frac{3}{8}$ in.	$\frac{7}{16}$ in.	$\frac{1}{2}$ in.	$\frac{5}{8}$ in.	$\frac{3}{4}$ in.
No. of threads	20	18	16	14	13	11	10
Diameter	$\frac{7}{8}$ in.	1 in.	$1\frac{1}{8}$ in.	$1\frac{1}{4}$ in.	$1\frac{3}{8}$ in.	$1\frac{1}{2}$ in.	$1\frac{3}{4}$ in.
No. of threads	9	8	7	7	6	6	5
Diameter	$1\frac{7}{8}$	2 in.	$2\frac{1}{4}$ in.	$2\frac{1}{2}$ in.	$2\frac{3}{4}$ in.	3 in.	$3\frac{1}{2}$ in.
No. of threads	5	$4\frac{1}{2}$	$4\frac{1}{2}$	4	4	$3\frac{1}{2}$	$3\frac{1}{4}$

STANDARD BOLT HEADS AND NUTS.

RECOMMENDED BY THE FRANKLIN INSTITUTE.

Diameter of rough head $= 1\frac{1}{2} \times$ diameter of bolt $+ \frac{1}{8}$ inch.
Thickness of rough head $= \frac{1}{2}$ diameter of head.
Diameter of rough nut $= 1\frac{1}{2} \times$ diameter of bolt $+ \frac{1}{8}$ inch.
Thickness of rough nut $=$ diameter of bolt.

The above standards for bolt heads and nuts were recommended by the Franklin Institute in December, 1864, but the proportions have not found general acceptance because of the odd sizes of bar required to make the nut.

SIZES AND WEIGHTS OF HOT PRESSED SQUARE NUTS.

THE SIZES ARE THE USUAL MANUFACTURERS', NOT THE FRANKLIN INSTITUTE STANDARD.

BOTH WEIGHTS AND SIZES ARE FOR THE UNFINISHED NUT.

Size of Bolt.	Weight of 100 Nuts.	Rough Hole.	Thickness of Nut.	Side of Square.	No. of Nuts in 100 lbs.
$\frac{1}{4}$ inch.	1.5	$\frac{7}{32}$	$\frac{1}{4}$	$\frac{1}{2}$	6800.
$\frac{3}{8}$ "	4.9	$\frac{11}{32}$	$\frac{3}{8}$	$\frac{3}{4}$	2050.
$\frac{1}{2}$ "	8.6	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{7}{8}$	1170.
$\frac{1}{2}$ "	11.8	$\frac{7}{16}$	$\frac{1}{2}$	1	850.
$\frac{5}{8}$ "	17.7	$\frac{9}{16}$	$\frac{5}{8}$	$1\frac{1}{8}$	570.
$\frac{5}{8}$ "	22.8	$\frac{9}{16}$	$\frac{5}{8}$	$1\frac{1}{4}$	440.
$\frac{3}{4}$ "	32.3	$\frac{21}{32}$	$\frac{3}{4}$	$1\frac{3}{8}$	310.
$\frac{3}{4}$ "	39.8	$\frac{21}{32}$	$\frac{3}{4}$	$1\frac{1}{2}$	251.
$\frac{7}{8}$ "	53.	$\frac{25}{32}$	$\frac{7}{8}$	$1\frac{5}{8}$	190.
$\frac{7}{8}$ "	63.	$\frac{25}{32}$	$\frac{7}{8}$	$1\frac{3}{4}$	159.
1 "	68.	$\frac{7}{8}$	1	$1\frac{3}{4}$	146.
1 "	94.	$\frac{7}{8}$	1	2	106.
$1\frac{1}{8}$ "	103.	$\frac{15}{16}$	$1\frac{1}{8}$	2	97.
$1\frac{1}{8}$ "	137.	$\frac{15}{16}$	$1\frac{1}{8}$	$2\frac{1}{4}$	73.
$1\frac{1}{4}$ "	145.	$1\frac{1}{16}$	$1\frac{1}{4}$	$2\frac{1}{4}$	69.
$1\frac{1}{4}$ "	186.	$1\frac{1}{16}$	$1\frac{1}{4}$	$2\frac{1}{2}$	54.
$1\frac{3}{8}$ "	247.	$1\frac{3}{16}$	$1\frac{3}{8}$	$2\frac{3}{4}$	41.
$1\frac{1}{2}$ "	319.	$1\frac{5}{16}$	$1\frac{1}{2}$	3	31.3
$1\frac{5}{8}$ "	400.	$1\frac{7}{16}$	$1\frac{5}{8}$	$3\frac{1}{4}$	24.8
$1\frac{3}{4}$ "	500.	$1\frac{9}{16}$	$1\frac{3}{4}$	$3\frac{1}{2}$	19.9
$1\frac{7}{8}$ "	620.	$1\frac{11}{16}$	$1\frac{7}{8}$	$3\frac{3}{4}$	16.2
2 "	750.	$1\frac{13}{16}$	2	4	13.4
$2\frac{1}{4}$ "	930.	2	$2\frac{1}{4}$	$4\frac{1}{4}$	10.7
$2\frac{1}{2}$ "	1130.	$2\frac{1}{4}$	$2\frac{1}{2}$	$4\frac{1}{2}$	8.9
3 "	1610.	$2\frac{11}{16}$	3	5	6.2

SPIKES, NAILS AND TACKS.

Size.	Length	Standard Steel Wire Nails. Common. Diam. Inches.	Common. No. per Pound.	Finishing. Diam. Inches.	Finishing. No. per Pound.	Steel Wire Spikes. Length	Steel Wire Spikes. Diam. Inches.	Steel Wire Spikes. No. per Pound.	Common Iron Nails. Size.	Common Iron Nails. Length	Common Iron Nails. No. per Pound.
2d	1 in.	.0524	1060	.0453	1558	3 in.	.1620	41	2d	1 in.	800
3d	1¼ "	.0588	640	.0508	913	3½ "	.1819	30	3d	1¼ "	400
4d	1½ "	.0720	380	.0508	761	4 "	.2043	23	4d	1½ "	300
5d	1¾ "	.0764	275	.0571	500	4½ "	.2294	17	5d	1¾ "	200
6d	2 "	.0808	210	.0641	350	5 "	.2576	13	6d	2 "	150
7d	2¼ "	.0858	160	.0641	315	5½ "	.2893	11	7d	2¼ "	120
8d	2½ "	.0935	115	.0720	214	6 "	.2893	10	8d	2½ "	85
9d	2¾ "	.0963	93	.0720	195	6½ "	.2249	7½	9d	2¾ "	75
10d	3 "	.1082	77	.0808	137	7 "	.2249	7	10d	3 "	60
12d	3¼ "	.1144	60	.0808	127	8 "	.3648	5	12d	3¼ "	50
16d	3½ "	.1285	48	.0907	90	9 "	.3648	4½	16d	3½ "	40
20d	4 "	.1620	31	.1019	62				20d	4 "	20
30d	4½ "	.1819	22						30d	4½ "	16
40d	5 "	.2043	17						40d	5 "	14
50d	5½ "	.2284	13						50d	5½ "	11
60d	6 "	.2576	11						60d	6 "	8

TACKS.

Title, Oz.	Length, Inches.	No. per Pound.	Title, Oz.	Length, Inches.	No. per Pound.	Title, Oz.	Length, Inches.	No. per Pound.
1	1/8	16000	4	7/16	4000	14	13/16	1143
1½	3/16	10666	6	9/16	2666	16	7/8	1000
2	1/4	8000	8	5/8	2000	18	15/16	888
2½	5/16	6400	10	11/16	1600	20	1	800
3	3/8	5333	12	3/4	1333	22	1 1/16	727
						24	1 1/8	666

HELICAL SPRINGS.

ORDINARY SIZES IN USE ON CARS.

	Diameter.		Height.		Capacity.	Weight.
	of steel.	outside of coil.	free.	closed.		average.
	Inches.	Inches.	Inches.	Inches.	Pounds.	Pounds.
	$\frac{15}{16}$	6	8	5	6000	$16\frac{1}{2}$
	1	$5\frac{1}{2}$	$8\frac{1}{2}$	6	7500	$18\frac{1}{2}$
	1	5	$10\frac{1}{2}$	8	8000	22
	$1\frac{1}{4}$	8	9	$5\frac{3}{4}$	10000	$33\frac{1}{2}$
	1 $\frac{5}{8}$	6 $3\frac{7}{8}$	$5\frac{1}{8}$	$3\frac{3}{8}$	10000	$16\frac{1}{2}$
	$1\frac{5}{16}$	8	9	6	11000	$36\frac{1}{2}$
	$1\frac{1}{8}$ $\frac{5}{8}$	6 $3\frac{5}{8}$	$5\frac{3}{4}$	$4\frac{1}{8}$	13000	21
	$1\frac{5}{16}$ $\frac{13}{16}$	8 $5\frac{1}{8}$	9	6	14000	51
	$1\frac{1}{8}$	$4\frac{7}{8}$	$4\frac{3}{8}$	$3\frac{3}{8}$	16000	10
	$1\frac{3}{8}$ $\frac{7}{8}$	8 5	8	$5\frac{3}{4}$	16000	$50\frac{1}{2}$
	$1\frac{1}{4}$ $\frac{3}{4}$	$6\frac{1}{4}$ $3\frac{5}{8}$	8	6	19000	35
	$1\frac{1}{4}$ $\frac{3}{4}$	$6\frac{1}{4}$ $3\frac{5}{8}$	6	$4\frac{1}{2}$	19000	26
4 coils.	$\frac{15}{16}$	5	$5\frac{1}{8}$	$3\frac{7}{8}$	28000	$35\frac{1}{2}$
	$\frac{15}{16}$	5	$6\frac{1}{8}$	$4\frac{5}{8}$	28000	43
	$1\frac{1}{16}$	$5\frac{5}{16}$	$6\frac{1}{8}$	$4\frac{5}{8}$	42000	$51\frac{1}{2}$
	$1\frac{1}{16}$	$5\frac{5}{16}$	$7\frac{1}{8}$	$5\frac{3}{8}$	42000	$60\frac{1}{2}$

AREAS AND CIRCUMFERENCES OF CIRCLES.

FOR DIAMETERS FROM $\frac{1}{16}$ TO 12, ADVANCING BY $\frac{1}{16}$ths.

Diameter.	Area.	Circumference	Diameter.	Area.	Circumference
0			$1\frac{1}{2}$	1.7671	4.7124
$\frac{1}{16}$	.0031	.1963	$\frac{9}{16}$	1.9175	4.9087
$\frac{1}{8}$	.0123	.3927	$\frac{5}{8}$	2.0739	5.1051
$\frac{3}{16}$	.0276	.5890	$\frac{11}{16}$	2.2365	5.3014
$\frac{1}{4}$	.0491	.7854	$1\frac{3}{4}$	2.4053	5.4978
$\frac{5}{16}$	.0767	.9817	$\frac{13}{16}$	2.5802	5.6941
$\frac{3}{8}$	.1104	1.1781	$\frac{7}{8}$	2.7612	5.8905
$\frac{7}{16}$	.1503	1.3744	$\frac{15}{16}$	2.9483	6.0868
$\frac{1}{2}$	.1963	1.5708	2	3.1416	6.2832
$\frac{9}{16}$	.2485	1.7671	$\frac{1}{16}$	3.3410	6.4795
$\frac{5}{8}$	.3068	1.9635	$\frac{1}{8}$	3.5466	6.6759
$\frac{11}{16}$	.3712	2.1698	$\frac{3}{16}$	3.7583	6.8722
$\frac{3}{4}$	.4418	2.3562	$2\frac{1}{4}$	3.9761	7.0686
$\frac{13}{16}$	.5185	2.5525	$\frac{5}{16}$	4.2000	7.2649
$\frac{7}{8}$	.6013	2.7489	$\frac{3}{8}$	4.4301	7.4613
$\frac{15}{16}$	.6903	2.9452	$\frac{7}{16}$	4.6664	7.6576
1	.7854	3.1416	$2\frac{1}{2}$	4.9087	7.8540
$\frac{1}{16}$	.8866	3.3379	$\frac{9}{16}$	5.1572	8.0503
$\frac{1}{8}$	.9940	3.5343	$\frac{5}{8}$	5.4119	8.2467
$\frac{3}{16}$	1.1075	3.7306	$\frac{11}{16}$	5.6727	8.4430
$1\frac{1}{4}$	1.2272	3.9270	$2\frac{3}{4}$	5.9396	8.6394
$\frac{5}{16}$	1.3530	4.1233	$\frac{13}{16}$	6.2126	8.8357
$\frac{3}{8}$	1.4849	4.3197	$\frac{7}{8}$	6.4918	9.0321
$\frac{7}{16}$	1.6230	4.5160	$\frac{15}{16}$	6.7771	9.2284

AREAS AND CIRCUMFERENCES OF CIRCLES—CONTINUED.

Diameter.	Area.	Circumference	Diameter.	Area.	Circumference
3	7.0686	9.4248	$4\frac{1}{2}$	15.904	14.137
$\frac{1}{16}$	7.3662	9.6211	$\frac{9}{61}$	16.349	14.534
$\frac{1}{8}$	7.6699	9.8175	$\frac{5}{8}$	16.800	14.530
$\frac{3}{16}$	7.9798	10.014	$\frac{11}{16}$	17.257	14.726
$3\frac{1}{4}$	8.2958	10.210	$4\frac{3}{4}$	17.721	14.923
$\frac{5}{16}$	8.6179	10.407	$\frac{13}{16}$	18.190	15.119
$\frac{3}{8}$	8.9462	10.603	$\frac{7}{8}$	18.665	15.315
$\frac{7}{16}$	9.2806	10.799	$\frac{15}{16}$	19.147	15.512
$3\frac{1}{2}$	9.6211	10.996	5	19.635	15.708
$\frac{9}{16}$	9.9678	11.192	$\frac{1}{16}$	20.129	15.904
$\frac{5}{8}$	10.321	11.388	$\frac{1}{8}$	20.629	16.101
$\frac{11}{16}$	10.680	11.585	$\frac{3}{16}$	21.135	16.297
$3\frac{3}{4}$	11.045	11.781	$5\frac{1}{4}$	21.648	16.493
$\frac{13}{16}$	11.416	11.977	$\frac{5}{16}$	22.166	16.690
$\frac{7}{8}$	11.793	12.174	$\frac{3}{8}$	22.691	16.886
$\frac{15}{16}$	12.177	12.370	$\frac{7}{16}$	23.221	17.082
4	12.566	12.566	$5\frac{1}{2}$	23.758	17.279
$\frac{1}{16}$	12.962	12.763	$\frac{9}{16}$	24.301	17.475
$\frac{1}{8}$	13.364	12.959	$\frac{5}{8}$	24.850	17.671
$\frac{3}{16}$	13.772	13.155	$\frac{11}{16}$	25.406	17.868
$4\frac{1}{4}$	14.186	13.352	$5\frac{3}{4}$	25.967	18.064
$\frac{5}{16}$	14.607	13.548	$\frac{13}{16}$	26.535	18.261
$\frac{3}{8}$	15.033	13.744	$\frac{7}{8}$	27.109	18.457
$\frac{7}{16}$	15.466	13.941	$\frac{15}{16}$	27.688	18.653

AREAS AND CIRCUMFERENCES OF CIRCLES—CONTINUED.

Diameter.	Area.	Circumference	Diameter.	Area.	Circumference
6	28.274	18.850	$7\frac{1}{2}$	44.179	23.562
$\frac{1}{16}$	28.866	19.046	$\frac{9}{16}$	44.918	23.758
$\frac{1}{8}$	29.465	19.242	$\frac{5}{8}$	45.664	23.955
$\frac{3}{16}$	30.069	19.439	$\frac{11}{16}$	46.415	24.151
$6\frac{1}{4}$	30.680	19.635	$7\frac{3}{4}$	47.173	24.347
$\frac{5}{16}$	31.296	19.831	$\frac{13}{16}$	47.937	24.544
$\frac{3}{8}$	31.919	20.028	$\frac{7}{8}$	48.707	24.740
$\frac{7}{16}$	32.548	20.224	$\frac{15}{16}$	49.483	24.936
$6\frac{1}{2}$	33.183	20.420	8	50.265	25.133
$\frac{9}{16}$	33.824	20.617	$\frac{1}{16}$	51.054	25.329
$\frac{5}{8}$	34.472	20.813	$\frac{1}{8}$	51.849	25.525
$\frac{11}{16}$	35.125	21.009	$\frac{3}{16}$	52.649	25.722
$6\frac{3}{4}$	35.785	21.206	$8\frac{1}{4}$	53.456	25.918
$\frac{13}{16}$	36.450	21.402	$\frac{5}{16}$	54.269	26.114
$\frac{7}{8}$	37.122	21.598	$\frac{3}{8}$	55.088	26.311
$\frac{15}{16}$	37.800	21.795	$\frac{7}{16}$	55.914	26.507
7	38.485	21.991	$8\frac{1}{2}$	56.745	26.704
$\frac{1}{16}$	39.175	22.187	$\frac{9}{16}$	57.583	26.900
$\frac{1}{8}$	39.871	22.384	$\frac{5}{8}$	58.426	27.096
$\frac{3}{16}$	40.574	22.580	$\frac{11}{16}$	59.276	27.293
$7\frac{1}{4}$	41.282	22.777	$8\frac{3}{4}$	60.132	27.489
$\frac{5}{16}$	41.997	22.973	$\frac{13}{16}$	60.994	27.685
$\frac{3}{8}$	42.718	23.169	$\frac{7}{8}$	61.862	27.882
$\frac{7}{16}$	43.445	23.366	$\frac{15}{16}$	62.737	28.078

AREAS AND CIRCUMFERENCES OF CIRCLES—CONTINUED.

Diameter.	Area.	Circumference	Diameter.	Area.	Circumference
9	63.617	28.274	10½	86.590	32.987
1/16	64.504	28.471	9/16	87.624	33.183
⅛	65.397	28.667	⅝	88.664	33.379
3/16	66.296	28.863	11/16	89.710	33.576
9¼	67.201	29.060	10¾	90.763	33.772
5/16	68.112	29.256	13/16	91.821	33.968
⅜	69.029	29.452	⅞	92.886	34.165
7/16	69.953	29.649	15/16	93.956	34.361
9½	70.882	29.345	11	95.033	34.558
9/16	71.818	30.041	1/16	96.116	34.754
⅝	72.760	30.238	⅛	97.205	34.950
11/16	73.708	30.434	3/16	98.301	35.147
9¾	74.662	30.631	11¼	99.402	35.343
13/16	75.622	30.827	5/16	100.51	35.539
⅞	76.589	31.023	⅜	101.62	35.736
15/16	77.561	31.220	7/16	102.74	35.932
10	78.540	31.416	11½	103.87	36.128
1/16	79.525	31.612	9/16	105.00	36.325
⅛	80.516	31.809	⅝	106.14	36.521
3/16	81.513	32.005	11/16	107.28	36.717
10¼	82.516	32.201	11¾	108.43	36.914
5/16	83.525	32.398	13/16	109.59	37.110
⅜	84.541	32.594	⅞	110.75	37.306
7/16	85.562	32.790	15/16	111.92	37.503
			12	113.09	37.699

AREAS AND CIRCUMFERENCES OF CIRCLES.

FOR DIAMETERS FROM $\frac{1}{10}$ TO 10, ADVANCING BY TENTHS.

Diameter.	Area.	Circumference	Diameter.	Area.	Circumference
0.0			2.5	4.9087	7.8540
.1	.007854	.31416	.6	5.3093	8.1681
.2	.031416	.62832	.7	5.7256	8.4823
.3	.070686	.94248	.8	6.1575	8.7965
.4	.12566	1.2566	.9	6.6052	9.1106
0.5	.19635	1.5708	3.0	7.0686	9.4248
.6	.28274	1.8850	.1	7.5477	9.7389
.7	.38485	2.1991	.2	8.0425	10.0531
.8	.50266	2.5133	.3	8.5530	10.3673
.9	.63617	2.8274	.4	9.0792	10.6814
1.0	.7854	3.1416	3.5	9.6211	10.9956
.1	.9503	3.4558	.6	10.1788	11.3097
.2	1.1310	3.7699	.7	10.7521	11.6239
.3	1.3273	4.0841	.8	11.3411	11.9381
.4	1.5394	4.3982	.9	11.9459	12.2522
1.5	1.7671	4.7124	4.0	12.5664	12.5664
.6	2.0106	5.0265	.1	13.2025	12.8805
.7	2.2698	5.3407	.2	13.8544	13.1947
.8	2.5447	5.6549	.3	14.5220	13.5088
.9	2.8353	5.9690	.4	15.2053	13.8230
2.0	3.1416	6.2832	4.5	15.9043	14.1372
.1	3.4636	6.5973	.6	16.6190	14.4513
.2	3.8013	6.9115	.7	17.3494	14.7655
.3	4.1548	7.2257	.8	18.0956	15.0796
.4	4.5239	7.5398	.9	18.8574	15.3938

AREAS AND CIRCUMFERENCES OF CIRCLES—CONTINUED.

Diameter.	Area.	Circumference	Diameter.	Area.	Circumference
9	63.617	28.274	10½	86.590	32.987
1/16	64.504	28.471	9/16	87.624	33.183
⅛	65.397	28.667	⅝	88.664	33.379
3/16	66.296	28.863	11/16	89.710	33.576
9¼	67.201	29.060	10¾	90.763	33.772
5/16	68.112	29.256	13/16	91.821	33.968
⅜	69.029	29.452	⅞	92.886	34.165
7/16	69.953	29.649	15/16	93.956	34.361
9½	70.882	29.345	11	95.033	34.558
9/16	71.818	30.041	1/16	96.116	34.754
⅝	72.760	30.238	⅛	97.205	34.950
11/16	73.708	30.434	3/16	98.301	35.147
9¾	74.662	30.631	11¼	99.402	35.343
13/16	75.622	30.827	5/16	100.51	35.539
⅞	76.589	31.023	⅜	101.62	35.736
15/16	77.561	31.220	7/16	102.74	35.932
10	78.540	31.416	11½	103.87	36.128
1/16	79.525	31.612	9/16	105.00	36.325
⅛	80.516	31.809	⅝	106.14	36.521
3/16	81.513	32.005	11/16	107.28	36.717
10¼	82.516	32.201	11¾	108.43	36.914
5/16	83.525	32.398	13/16	109.59	37.110
⅜	84.541	32.594	⅞	110.75	37.306
7/16	85.562	32.790	15/16	111.92	37.503
			12	113.09	37.699

AREAS AND CIRCUMFERENCES OF CIRCLES.

FOR DIAMETERS FROM $\frac{1}{10}$ TO 10, ADVANCING BY TENTHS.

Diameter.	Area.	Circumference	Diameter.	Area.	Circumference
0.0			2.5	4.9087	7.8540
.1	.007854	.31416	.6	5.3093	8.1681
.2	.031416	.62832	.7	5.7256	8.4823
.3	.070686	.94248	.8	6.1575	8.7965
.4	.12566	1.2566	.9	6.6052	9.1106
0.5	.19635	1.5708	3.0	7.0686	9.4248
.6	.28274	1.8850	.1	7.5477	9.7389
.7	.38485	2.1991	.2	8.0425	10.0531
.8	.50266	2.5133	.3	8.5530	10.3673
.9	.63617	2.8274	.4	9.0792	10.6814
1.0	.7854	3.1416	3.5	9.6211	10.9956
.1	.9503	3.4558	.6	10.1788	11.3097
.2	1.1310	3.7699	.7	10.7521	11.6239
.3	1.3273	4.0841	.8	11.3411	11.9381
.4	1.5394	4.3982	.9	11.9459	12.2522
1.5	1.7671	4.7124	4.0	12.5664	12.5664
.6	2.0106	5.0265	.1	13.2025	12.8805
.7	2.2698	5.3407	.2	13.8544	13.1947
.8	2.5447	5.6549	.3	14.5220	13.5088
.9	2.8353	5.9690	.4	15.2053	13.8230
2.0	3.1416	6.2832	4.5	15.9043	14.1372
.1	3.4636	6.5973	.6	16.6190	14.4513
.2	3.8013	6.9115	.7	17.3494	14.7655
.3	4.1548	7.2257	.8	18.0956	15.0796
.4	4.5239	7.5398	.9	18.8574	15.3938

AREAS AND CIRCUMFERENCES OF CIRCLES—CONTINUED.

Diameter.	Area.	Circumference	Diameter.	Area.	Circumference
5.0	19.6350	15.7080	7.5	44.1786	23.5619
.1	20.4282	16.0221	.6	45.3646	23.8761
.2	21.2372	16.3363	.7	46.5663	24.1903
.3	22.0618	16.6504	.8	47.7836	24.5044
.4	22.9022	16.9646	.9	49.0167	24.8186
5.5	23.7583	17.2788	8.0	50.2655	25.1327
.6	24.6301	17.5929	.1	51.5300	25.4469
.7	25.5176	17.9071	.2	52.8102	25.7611
.8	26.4208	18.2212	.3	54.1061	26.0752
.9	27.3397	18.5354	.4	55.4177	26.3894
6.0	28.2743	18.8496	8.5	56.7450	26.7035
.1	29.2247	19.1637	.6	58.0880	27.0177
.2	30.1907	19.4779	.7	59.4468	27.3319
.3	31.1725	19.7920	.8	60.8212	27.6460
.4	32.1699	20.1062	.9	62.2114	27.9602
6.5	33.1831	20.4204	9.0	63.6173	28.2743
.6	34.2119	20.7345	.1	65.0388	28.5885
.7	35.2565	21.0487	.2	66.4761	28.9027
.8	36.3168	21.3628	.3	67.9291	29.2168
.9	37.3928	21.6770	.4	69.3978	29.5310
7.0	38.4845	21.9911	9.5	70.8822	29.8451
.1	39.5919	22.3053	.6	72.3823	30.1593
.2	40.7150	22.6195	.7	73.8981	30.4734
.3	41.8539	22.9336	.8	75.4296	30.7876
.4	43.0084	23.2478	.9	76.9769	31.1018
			10.0	78.5398	31.4159

AREAS AND CIRCUMFERENCES OF CIRCLES—CONTINUED.

To compute the area or circumference of a diameter greater than 10 and less than 101:

Take out the area or circumference from the table as though the number had one decimal, and move the decimal point two places to the right for the area, and one place for the circumference.

EXAMPLE.—Wanted the area and circumference of 98. The tabular area of 9.8 is 75.4296, and circumference 30.7876. Therefore the area for 98 = 7542.96, and the circumference = 307.876.

To compute the area or circumference of a diameter greater than 100:

Divide by a factor, as 2, 3, 4, 5, etc., if practicable, that will leave a quotient to be found in the table, then multiply the tabular area of the quotient by the *square* of the factor, or the tabular circumference by the factor.

EXAMPLE.—Wanted the area and circumference of 140. Dividing by 2, the quotient is 70, for which the area is 3848.45 and the circumference is 219.911. Therefore the area of 140 = 3848.45 × 4 = 15393.80, and the circumference 219.911 × 2 = 439.822.

DECIMALS OF AN INCH FOR EACH 1-64TH.

1/32	1/64	Decimal.	Fract'n	1/32	1/64	Decimal.	Fract'n	1/32	1/64	Decimal.	Fract'n
	1	.015625		11	22	.34375			43	.671875	
1	2	.03125			23	.359375		22	44	.6875	11/16
	3	.046875		12	24	.375	3/8		45	.703125	
2	4	.0625	1/16		25	.390625		23	46	.71875	
	5	.078125		13	26	.40625			47	.734375	
3	6	.09375			27	.421875		24	48	.75	3/4
	7	.109375		14	28	.4375	7/16		49	.765625	
4	8	.125	1/8		29	.453125		25	50	.78125	
	9	.140625		15	30	.46875			51	.796875	
5	10	.15625			31	.484375		26	52	.8125	13/16
	11	.171875		16	32	.50	1/2		53	.828125	
6	12	.1875	3/16		33	.515625		27	54	.84375	
	13	.203125		17	34	.53125			55	.859375	
7	14	.21875			35	.546875		28	56	.875	7/8
	15	.234375		18	36	.5625	9/16		57	.890625	
8	16	.25	1/4		37	.578125		29	58	.90625	
	17	.265625		19	38	.59375			59	.921875	
9	18	.28125			39	.609375		30	60	.9375	15/16
	19	.296875		20	40	.625	5/8		61	.953125	
10	20	.3125	5/16		41	.640625		31	62	.96875	
	21	.328125		21	42	.65625			63	.984375	
								32	64	1.00	1

SIZES AND WEIGHTS OF WROUGHT WASHERS.

Size of bolt..... ...	3/8 in.	1/2 in.	5/8 in.	3/4 in.	7/8 in.	1 in.	1 1/8 in.
" " hole	7/16 "	9/16 "	11/16 "	13/16 "	31/32 "	1 1/8 "	1 1/4 "
Outside diameter	1 "	1 1/2 "	1 1/2 "	1 3/4 "	2 "	2 1/2 "	2 3/4 "
Thickness B. W. G.....	No. 14	No. 11	No. 11	No. 11	No. 10	No. 8	No. 8
Number in 1 pound...	76	33	24	17	12	6	5

RAILWAY CURVES.

To find the degree or radius of a curve, stretch taut a 50-foot tape-line on the inner side of the rail, and measure the perpendicular distance (which is the "middle ordinate") from the center of the tape-line to the inner edge of the rail.

The radius and degree of the curve corresponding to this middle ordinate may then be found in the following table.

Degree.	Radius in Feet.	Middle Ordinate in Inches.	Degree.	Radius in Feet.	Middle Ordinate in Inches.
30′	11460	.22	11°	522	7.20
1°	5730	.66	12°	478	7.87
2°	2865	1.32	13°	442	8.51
3°	1910	1.97	14°	410	9.17
4°	1433	2.63	15°	383	9.80
5°	1146	3.28	16°	359	10.49
6°	955	3.94	17°	338	11.11
7°	819	4.57	18°	320	11.78
8°	717	5.24	19°	303	12.41
9°	637	5.89	20°	288	13.06
10°	574	6.54			

To ascertain the radius corresponding to any degree, divide 5730 (the radius of a 1° curve) by the degree of the curve under consideration.

EXAMPLE.—Radius of a 5° curve $= \frac{5730}{5} = 1146$.

TABLE OF BOARD MEASURE.

FEET OF BOARD MEASURE CONTAINED IN ONE RUNNING FOOT OF TIMBER OF DIFFERENT DIMENSIONS.

Width in Inches.	Thickness in Inches.												Width in Inches.
	1	1¼	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾	
¼	.020	.026	.031	.036	.041	.046	.052	.057	.062	.067	.072	.078	¼
½	.041	.052	.062	.072	.083	.093	.104	.114	.125	.135	.145	.156	½
¾	.062	.078	.093	.109	.125	.140	.156	.171	.187	.203	.218	.234	¾
1	.083	.104	.125	.145	.166	.187	.208	.229	.250	.270	.291	.312	1
¼	.104	.130	.156	.182	.208	.234	.260	.286	.312	.338	.364	.390	¼
½	.125	.156	.187	.218	.250	.281	.312	.343	.375	.406	.437	.468	½
¾	.145	.182	.218	.255	.291	.328	.364	.401	.437	.474	.510	.546	¾
2	.166	.208	.250	.291	.333	.375	.416	.458	.500	.541	.583	.625	2
¼	.187	.234	.281	.328	.375	.421	.468	.515	.562	.609	.656	.703	¼
½	.208	.260	.312	.364	.416	.468	.520	.572	.625	.677	.729	.781	½
¾	.229	.286	.343	.401	.458	.515	.572	.630	.687	.744	.802	.859	¾
3	.250	.312	.375	.437	.500	.562	.625	.687	.750	.812	.875	.937	3
¼	.270	.338	.406	.473	.541	.609	.677	.744	.812	.880	.947	1.01	¼
½	.291	.364	.437	.510	.583	.656	.729	.802	.875	.947	1.02	1.09	½
¾	.312	.390	.468	.546	.625	.703	.781	.859	.937	1.01	1.09	1.17	¾
4	.333	.416	.500	.583	.666	.750	.833	.916	1.00	1.08	1.16	1.25	4
¼	.354	.442	.531	.619	.708	.796	.885	.974	1.06	1.15	1.24	1.34	¼
½	.375	.468	.562	.656	.750	.843	.937	1.03	1.12	1.21	1.31	1.40	½
¾	.395	.494	.593	.692	.791	.890	.989	1.08	1.18	1.28	1.38	1.48	¾
5	.416	.520	.625	.729	.833	.937	1.04	1.14	1.25	1.35	1.45	1.56	5
¼	.437	.546	.656	.765	.875	.984	1.09	1.20	1.31	1.42	1.53	1.64	¼
½	.458	.572	.687	.802	.916	1.03	1.14	1.26	1.37	1.49	1.60	1.72	½
¾	.479	.599	.718	.838	.958	1.07	1.19	1.31	1.43	1.55	1.67	1.80	¾

TABLE OF BOARD MEASURE.

FEET OF BOARD MEASURE CONTAINED IN ONE RUNNING FOOT OF TIMBER OF DIFFERENT DIMENSIONS.

Width in Inches.	Thickness in Inches.												Width in Inches.
	1	1¼	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾	
6	.500	.625	.750	.875	1.00	1.12	1.25	1.37	1.50	1.62	1.75	1.87	6
¼	.520	.651	.781	.911	1.04	1.17	1.30	1.43	0.56	1.69	1.82	1.95	¼
½	.541	.677	.812	.947	1.08	1.21	1.35	1.49	1.62	1.76	1.89	2.03	½
¾	.562	.703	.843	.984	1.12	1.26	1.40	1.54	1.68	1.82	1.96	2.10	¾
7	.583	.729	.875	1.02	1.16	1.31	1.45	1.60	1.75	1.89	2.04	2.18	7
¼	.604	.755	.906	1.05	1.20	1.35	1.51	1.66	1.81	1.96	2.11	2.26	¼
½	.625	.781	.937	1.09	1.25	1.40	1.56	1.71	1.87	2.03	2.18	2.34	½
¾	.645	.807	.968	1.13	1.29	1.45	1.61	1.77	1.93	2.09	2.26	2.42	¾
8	.666	8.33	1.00	1.16	1.33	1.50	1.66	1.83	2.00	2.16	2.33	2.50	8
¼	.687	.859	1.03	1.20	1.37	1.54	1.71	1.89	2.06	2.23	2.40	2.57	¼
½	.708	.885	1.06	1.24	1.41	1.59	1.77	1.94	2.12	2.30	2.47	2.65	½
¾	.729	.911	1.09	1.27	1.45	1.64	1.82	2.00	2.18	2.37	2.55	2.73	¾
9	.750	.937	1.12	1.31	1.50	1.68	1.87	2.06	2.25	2.43	2.62	2.81	9
¼	.770	.963	1.15	1.34	1.54	1.73	1.92	2.12	2.31	2.50	2.69	2.89	¼
½	.791	.989	1.18	1.38	1.58	1.78	1.97	2.17	2.37	2.57	2.77	2.96	½
¾	.812	1.01	1.21	1.42	1.62	1.82	2.03	2.23	2.43	2.64	2.84	3.04	¾
10	.833	1.04	1.25	1.45	1.66	1.87	2.08	2.29	2.50	2.70	2.91	3.12	10
¼	.854	1.06	1.28	1.49	1.70	1.92	2.13	2.34	2.56	2.77	2.99	3.20	¼
½	.875	1.09	1.31	1.53	1.75	1.96	2.18	2.40	2.62	2.84	3.06	3.28	½
¾	.895	1.12	1.34	1.56	1.79	2.01	2.24	2.46	2.68	2.91	3.13	3.35	¾
11	.916	1.14	1.37	1.60	1.83	2.06	2.29	2.52	2.75	2.97	3.20	3.43	11
¼	.937	1.17	1.40	1.64	1.87	2.10	2.34	2.57	2.81	3.04	3.28	3.51	¼
½	.958	1.19	1.43	1.67	1.91	2.15	2.39	2.63	2.87	3.11	3.35	3.59	½
¾	.979	1.22	1.46	1.71	1.95	2.20	2.44	2.69	2.93	3.18	3.42	3.67	¾
12	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	12

TABLE OF BOARD MEASURE.

FEET OF BOARD MEASURE CONTAINED IN ONE RUNNING FOOT OF TIMBER OF DIFFERENT DIMENSIONS.

Width in Inches.	Thickness in Inches.												Width in Inches.
	4	4¼	4½	4¾	5	5¼	5½	5¾	6	6¼	6½	6¾	
0													
¼	.083	.088	.093	.099	.104	.109	.114	.119	.125	.130	.135	.140	¼
½	.166	.177	.187	.197	.208	.218	.229	.239	.250	.260	.270	.281	½
¾	.250	.265	.281	.296	.312	.328	.343	.359	.375	.390	.406	.421	¾
1	.333	.354	.375	.395	.416	.437	.458	.479	.500	.520	.541	.562	1
¼	.416	.442	.468	.494	.520	.546	.572	.599	.625	.651	.677	.703	¼
½	.500	.531	.562	.593	.625	.656	.687	.718	.750	.781	.812	.843	½
¾	.583	.619	.656	.692	.729	.765	.802	.838	.875	.911	.947	.984	¾
2	.666	.708	.750	.791	.833	.875	.916	.958	1.00	1.04	1.08	1.12	2
¼	.750	.796	.843	.890	.937	.984	1.03	1.07	1.12	1.17	1.21	1.26	¼
½	.833	.885	.937	.989	1.04	1.09	1.14	1.19	1.25	1.30	1.35	1.40	½
¾	.916	.974	1.03	.108	1.14	1.20	1.26	1.31	1.37	1.43	1.49	1.54	¾
3	1.00	1.06	1.12	1.18	1.25	1.34	1.37	1.43	1.50	1.56	1.62	1.68	3
¼	1.08	1.15	1.21	1.28	1.35	1.42	1.49	1.55	1.62	1.69	1.76	1.82	¼
½	1.16	1.24	1.31	1.38	1.45	1.53	1.60	1.67	1.75	1.82	1.89	1.96	½
¾	1.25	1.32	1.40	1.48	1.56	1.64	1.71	1.79	1.87	1.95	2.03	2.10	¾
4	1.33	1.41	1.50	1.58	1.66	1.75	1.83	1.91	2.00	2.08	2.16	2.25	4
¼	1.41	1.50	1.59	1.68	1.77	1.85	1.94	2.03	2.12	2.21	2.30	2.39	¼
½	1.50	1.59	1.68	1.78	1.87	1.96	2.06	2.15	2.25	2.34	2.43	2.53	½
¾	1.58	1.68	1.78	1.88	1.97	2.07	2.17	2.27	2.37	2.47	2.57	2.67	¾
5	1.66	1.77	1.87	1.97	2.08	2.18	2.29	2.39	2.50	2.60	2.70	2.81	5
¼	1.75	1.85	1.96	2.07	2.18	2.29	2.40	2.51	2.62	2.73	2.84	2.95	¼
½	1.83	1.94	2.06	2.17	2.29	2.40	2.52	2.63	2.75	2.86	2.97	3.09	½
¾	1.91	2.03	2.15	2.27	2.39	2.51	2.63	2.75	2.87	2.99	3.11	3.23	¾

TABLE OF BOARD MEASURE.

FEET OF BOARD MEASURE CONTAINED IN ONE RUNNING FOOT OF TIMBER OF DIFFERENT DIMENSIONS.

Width in Inches.	Thickness in Inches.												Width in Inches.
	4	4¼	4½	4¾	5	5¼	5½	5¾	6	6¼	6½	6¾	
6	2.00	2.12	2.25	2.37	2.50	2.62	2.75	2.87	3.00	3.12	3.25	3.37	6
¼	2.08	2.21	2.34	2.47	2.60	2.73	2.86	2.99	3.12	3.25	3.38	3.51	¼
½	2.16	2.30	2.43	2.57	2.70	2.84	3.97	3.11	3.25	3.38	3.52	3.65	½
¾	2.25	2.39	2.53	2.67	2.81	2.95	3.09	3.23	3.37	3.51	3.65	3.79	¾
7	2.33	2.47	2.62	2.77	2.91	3.06	3.20	3.35	3.50	3.64	3.79	3.93	7
¼	2.41	2.56	2.71	2.87	3.02	3.17	3.32	3.47	3.62	3.77	3.92	4.07	¼
½	2.50	2.65	2.81	2.96	3.12	3.28	3.43	3.59	3.75	3.90	4.06	4.21	½
¾	2.58	2.74	2.90	3.06	3.22	3.39	3.55	3.71	3.87	4.03	4.19	4.35	¾
8	2.66	2.83	3.00	3.16	3.33	3.50	3.66	3.83	4.00	4.16	4.33	4.50	8
¼	2.75	2.92	3.09	3.26	3.43	3.60	3.78	3.95	4.12	4.29	4.46	4.64	¼
½	2.83	3.01	3.18	3.36	3.54	3.71	3.89	4.07	4.25	4.42	4.60	4.78	½
¾	2.91	3.09	3.28	3.46	3.64	3.82	4.01	4.19	4.37	4.55	4.74	4.92	¾
9	3.00	3.18	3.37	3.56	3.75	3.93	4.12	4.31	4.50	4.68	4.87	5.06	9
¼	3.08	3.27	3.46	3.66	3.85	4.04	4.24	4.43	4.62	4.81	5.01	5.20	¼
½	3.16	3.36	3.56	3.76	3.95	4.15	4.35	4.55	4.75	4.94	5.14	5.34	½
¾	3.25	3.45	3.65	3.85	4.06	4.26	4.46	4.67	4.87	5.07	5.28	5.48	¾
10	3.33	3.54	3.75	3.95	4.16	4.37	4.58	4.79	5.00	5.20	5.41	5.62	10
¼	3.41	3.63	3.84	4.05	4.27	4.48	4.69	4.91	5.12	5.33	5.55	5.76	¼
½	3.50	3.71	3.93	4.15	4.37	4.59	4.81	5.03	5.25	5.46	5.68	5.90	½
¾	3.58	3.80	4.03	4.25	4.47	4.70	4.92	5.15	5.37	5.59	5.82	6.04	¾
11	3.66	3.89	4.12	4.35	4.58	4.81	5.04	5.27	5.50	5.72	5.95	6.18	11
¼	3.75	3.98	4.21	4.45	4.68	4.92	5.15	5.39	5.62	5.85	6.09	6.32	¼
½	3.83	4.07	4.31	4.55	4.79	5.03	5.27	5.51	5.75	5.99	2.22	6.46	½
¾	3.91	4.16	4.40	4.65	4.89	5.14	5.38	5.63	5.87	6.12	6.35	6.60	¾
12	4.00	4.25	4.50	4.75	5.00	5.25	5.50	5.75	6.00	6.25	6.50	6.75	12

TABLE OF BOARD MEASURE.

FEET OF BOARD MEASURE CONTAINED IN ONE RUNNING FOOT OF TIMBER OF DIFFERENT DIMENSIONS.

Width in Inches.	Thickness in Inches.												Width in Inches.
	7	7¼	7½	7¾	8	8¼	8½	8¾	9	9¼	9½	9¾	
0													0
¼	.145	.151	.156	.161	.166	.171	.177	.182	.187	.192	.197	.203	¼
½	.291	.302	.312	.322	.333	.343	.354	.364	.375	.385	.395	.406	½
¾	.437	.453	.468	.484	.500	.515	.531	.546	.562	.578	.593	.609	¾
1	.583	.604	.625	.645	.666	.687	.708	.729	.750	.770	.791	.812	1
¼	.729	.755	.781	.807	.833	.859	.885	.911	.937	.963	.989	1.01	¼
½	.875	.906	.937	.968	1.00	1.03	1.06	1.09	1.12	1.15	1.18	1.21	½
¾	1.02	1.05	1.09	1.13	1.16	1.20	1.24	1.27	1.31	1.34	1.38	1.42	¾
2	1.16	1.20	1.25	1.29	1.33	1.37	1.41	1.45	1.50	1.54	1.58	1.62	2
¼	1.31	1.35	1.40	1.45	1.50	1.54	1.59	1.64	1.68	1.73	1.78	1.82	¼
½	1.45	1.51	1.56	1.61	1.66	1.71	1.77	1.82	1.87	1.92	1.97	2.03	½
¾	1.60	1.65	1.71	1.77	1.83	1.89	1.94	2.00	2.06	2.12	2.17	2.23	¾
3	1.75	1.81	1.87	1.93	2.00	2.06	2.12	2.18	2.25	2.31	2.37	2.43	3
¼	1.89	1.96	2.03	2.09	2.16	2.23	2.30	2.37	2.43	2.50	2.57	2.64	¼
½	2.04	2.11	2.18	2.26	2.33	2.40	2.47	2.55	2.62	2.69	2.77	2.84	½
¾	2.18	2.26	2.34	2.42	2.50	2.57	2.65	2.73	2.81	2.89	2.96	3.04	¾
4	2.33	2.41	2.50	2.58	2.66	2.75	2.83	2.91	3.00	3.08	3.16	3.25	4
¼	2.47	2.56	2.65	2.74	2.83	2.92	3.01	3.09	3.18	3.27	3.36	3.45	¼
½	2.62	2.71	2.81	2.90	3.00	3.09	3.18	3.28	3.37	3.46	3.56	3.65	½
¾	2.77	2.87	2.96	3.06	3.16	3.26	3.36	3.46	3.56	3.66	3.76	3.85	¾
5	2.91	3.02	3.12	3.22	3.33	3.43	3.54	3.64	3.75	3.85	3.95	4.06	5
¼	3.06	3.17	3.28	3.39	3.50	3.60	3.71	3.82	3.93	4.04	4.15	4.26	¼
½	3.20	3.32	3.43	3.55	3.66	3.78	3.89	4.01	4.12	4.24	4.35	4.46	½
¾	3.35	3.47	3.59	3.71	3.83	3.95	4.07	4.19	4.31	4.43	4.55	4.67	¾

TABLE OF BOARD MEASURE.

FEET OF BOARD MEASURE CONTAINED IN ONE RUNNING FOOT OF TIMBER OF DIFFERENT DIMENSIONS.

Width in Inches.	Thickness in Inches.												Width in Inches.
	7	7¼	7½	7¾	8	8¼	8½	8¾	9	9¼	9½	9¾	
6	3.50	3.62	3.75	3.87	4.00	4.12	4.25	4.37	4.50	4.62	4.75	4.87	6
¼	3.64	3.77	3.90	4.03	4.16	4.29	4.42	4.55	4.68	4.81	4.94	5.07	¼
½	3.79	3.92	4.06	4.19	4.33	4.46	4.60	4.74	4.87	5.01	5.14	5.28	½
¾	3.93	4.07	4.21	4.35	4.50	4.64	4.78	4.92	5.06	5.20	5.34	5.48	¾
7	4.08	4.22	4.37	4.52	4.66	4.81	4.95	5.10	5.25	5.36	5.54	5.68	7
¼	4.22	4.38	4.53	4.68	4.83	4.98	5.13	5.28	5.43	5.59	5.74	5.89	¼
½	4.37	4.53	4.68	4.84	5.00	5.15	5.31	5.46	5.62	5.78	5.93	6.09	½
¾	4.52	4.68	4.84	5.00	5.16	5.32	5.49	5.65	5.81	5.97	6.13	6.29	¾
8	4.66	4.83	5.00	5.16	5.33	5.50	5.66	5.83	6.00	6.16	6.33	6.50	8
¼	4.81	4.98	5.15	5.32	5.50	5.67	5.84	6.01	6.18	6.35	6.53	6.70	¼
½	4.95	5.13	5.31	5.49	5.66	5.84	6.02	6.19	6.37	6.55	6.72	6.90	½
¾	5.10	5.28	5.46	5.65	5.83	6.01	6.19	6.38	6.56	6.74	6.92	7.10	¾
9	5.24	5.43	5.62	5.81	6.00	6.18	6.37	6.56	6.75	6.93	7.12	7.31	9
¼	5.39	5.58	5.78	5.97	6.16	6.35	6.55	6.74	6.93	7.13	7.32	7.51	¼
½	5.54	5.74	5.93	6.13	6.33	6.53	6.72	6.92	7.12	7.32	7.52	7.71	½
¾	5.68	5.89	6.09	6.29	6.50	6.70	6.90	7.10	7.31	7.51	7.71	7.92	¾
10	5.83	6.04	6.25	6.45	6.66	6.87	7.08	7.29	7.50	7.70	7.91	8.12	10
¼	5.97	6.19	6.40	6.62	6.83	7.04	7.26	7.47	7.68	7.90	8.11	8.32	¼
½	6.12	6.34	6.56	6.78	7.00	7.21	7.43	7.65	7.87	8.09	8.31	8.53	½
¾	6.27	6.49	6.71	6.94	7.16	7.39	7.61	7.83	8.06	8.28	8.51	8.73	¾
11	6.41	6.64	6.87	7.10	7.33	7.56	7.79	8.02	8.25	8.47	8.70	8.93	11
¼	6.56	6.79	7.03	7.26	7.50	7.73	7.96	8.20	8.43	8.67	8.90	9.14	¼
½	6.70	6.94	7.18	7.42	7.66	7.90	8.14	8.38	8.62	8.86	9.10	9.34	½
¾	6.85	7.09	7.34	7.58	7.83	8.07	8.32	8.56	8.81	9.05	9.30	9.54	¾
12	7.00	7.25	7.50	7.75	8.00	8.25	8.50	8.75	9.00	9.25	9.50	9.75	12

TABLE OF BOARD MEASURE.

FEET OF BOARD MEASURE CONTAINED IN ONE RUNNING FOOT OF TIMBER OF DIFFERENT DIMENSIONS.

Width in Inches.	Thickness in Inches.												Width in Inches.
	10	10¼	10½	10¾	11	11¼	11½	11¾	12	12¼	12½	12¾	
0													0
¼	.208	.213	.218	.224	.229	.234	.239	.244	.250	.255	.260	.265	¼
½	.416	.427	.437	.447	.458	.468	.479	.489	.500	.510	.520	.530	½
¾	.625	.640	.656	.671	.687	.703	.718	7.34	.750	.765	.780	.795	¾
1	.833	.854	.875	.895	.916	.937	.958	.979	1.00	1.02	1.04	1.06	1
¼	1.04	1.06	1.09	1.12	1.14	1.17	1.19	1.22	1.25	1.27	1.30	1.33	¼
½	1.25	1.28	1.31	1.34	1.37	1.40	1.43	1.46	1.50	1.53	1.56	1.59	½
¾	1.45	1.49	1.53	1.56	1.60	1.64	1.67	1.71	1.75	1.78	1.82	1.85	¾
2	1.66	1.70	1.75	1.79	1.83	1.87	1.91	1.95	2.00	2.04	2.08	2.12	2
¼	1.87	1.92	1.96	2.01	2.06	2.10	2.15	2.20	2.25	2.29	2.34	2.38	¼
½	2.08	2.13	2.18	2.24	2.29	2.34	2.39	2.44	2.50	2.55	2.60	2.65	½
¾	2.29	2.34	2.40	2.46	2.52	2.57	2.63	2.69	2.75	2.80	2.86	2.91	¾
3	2.50	2.56	2.62	2.68	2.75	2.81	2.87	2.93	3.00	3.06	3.12	3.18	3
¼	2.70	2.77	2.84	2.91	2.98	3.04	3.11	3.18	3.25	3.31	3.38	3.45	¼
½	2.91	2.99	3.06	3.13	3.20	3.28	3.35	3.42	3.50	3.57	3.64	3.72	½
¾	3.12	3.20	3.28	3.35	3.43	3.51	3.59	3.67	3.75	3.82	3.90	3.98	¾
4	3.33	3.41	3.50	3.58	3.66	3.75	3.83	3.91	4.00	4.08	4.16	4.25	4
¼	3.54	3.63	3.71	3.80	3.89	3.98	4.07	4.16	4.25	4.33	4.42	4.51	¼
½	3.75	3.84	3.93	4.03	4.12	4.21	4.31	4.40	4.50	4.59	4.68	4.77	½
¾	3.95	4.05	4.15	4.25	4.35	4.45	4.55	4.65	4.75	4.84	4.94	5.04	¾
5	4.16	4.27	4.37	4.47	4.58	4.68	4.79	4.89	5.00	5.10	5.20	5.31	5
¼	4.37	4.48	4.59	4.70	4.81	4.92	5.03	5.14	5.25	5.35	5.46	5.56	¼
½	4.58	4.69	4.81	4.92	5.04	5.15	5.27	5.38	5.50	5.61	5.72	5.83	½
¾	4.79	4.91	5.03	5.15	5.27	5.39	5.51	5.63	5.75	5.87	5.99	6.11	¾

TABLE OF BOARD MEASURE.

FEET OF BOARD MEASURE CONTAINED IN ONE RUNNING FOOT OF TIMBER OF DIFFERENT DIMENSIONS.

Width in Inches.	Thickness in Inches.												Width in Inches.
	10	10¼	10½	10¾	11	11¼	11½	11¾	12	12¼	12½	12¾	
6	5.00	5.12	5.25	5.37	5.50	5.62	5.75	5.87	6.00	6.12	6.25	6.37	6
¼	5.20	5.33	5.46	5.59	5.72	5.85	5.99	6.12	6.25	6.38	6.51	6.64	¼
½	5.41	5.55	5.68	5.82	5.95	6.09	6.22	6.36	6.50	6.63	6.77	6.90	½
¾	5.62	5.76	5.90	6.04	6.18	6.32	6.46	6.60	6.75	6.89	7.03	7.17	¾
7	5.83	5.97	6.12	6.27	6.41	6.56	6.70	6.85	7.00	7.14	7.29	7.44	7
¼	6.04	6.19	6.34	6.49	6.64	6.79	6.94	7.09	7.25	7.40	7.55	7.70	¼
½	6.25	6.40	6.56	6.71	6.87	7.03	7.18	7.34	7.50	7.65	7.81	7.97	½
¾	6.45	6.62	6.78	6.94	7.10	7.26	7.42	7.58	7.75	7.91	8.07	8.23	¾
8	6.66	6.83	7.00	7.16	7.33	7.50	7.66	7.83	8.00	8.16	8.33	8.50	8
¼	6.87	7.04	7.21	7.39	7.56	7.73	7.90	8.07	8.25	8.42	8.59	8.76	¼
½	7.08	7.26	7.43	7.61	7.79	7.96	8.14	8.32	8.50	8.67	8.85	9.03	½
¾	7.29	7.47	7.65	7.83	8.02	8.20	8.38	8.56	8.75	8.93	9.11	9.29	¾
9	7.50	7.68	7.87	8.06	8.25	8.43	8.62	8.81	9.00	9.18	9.37	9.56	9
¼	7.70	7.90	8.09	8.28	8.47	8.67	8.86	9.05	9.25	9.44	9.63	9.82	¼
½	7.91	8.11	8.31	8.51	8.70	8.90	9.10	9.30	9.50	9.69	9.89	10.09	½
¾	8.12	8.32	8.53	8.73	8.93	9.14	9.34	9.54	9.75	9.95	10.16	10.35	¾
10	8.33	8.54	8.75	8.95	9.16	9.37	9.58	9.79	10.00	10.20	10.42	10.62	10
¼	8.54	8.75	8.96	9.18	9.39	9.60	9.82	10.04	10.25	10.46	10.68	10.89	¼
½	8.75	8.96	9.18	9.40	9.62	9.84	10.06	10.28	10.50	10.72	10.94	11.15	½
¾	8.95	9.18	9.40	9.63	9.85	10.08	10.30	10.53	10.75	10.97	11.20	11.42	¾
11	9.16	9.39	9.62	9.85	10.08	10.31	10.54	10.77	11.00	11.22	11.46	11.68	11
¼	9.37	9.60	9.84	10.08	10.31	10.55	10.78	11.02	11.25	11.48	11.72	11.95	¼
½	9.58	9.82	10.06	10.30	10.54	10.78	11.02	11.26	11.50	11.74	11.98	12.21	½
¾	9.79	10.04	10.28	10.53	10.77	11.02	11.26	11.51	11.75	11.99	12.24	12.48	¾
12	10.00	10.25	10.50	10.75	11.00	11.25	11.50	11.75	12.00	12.25	12.50	12.75	12

STANDARD BOX CAR.

Detail Bill of Material in Body.

DIMENSIONS.

Length over end sills, 34 feet 8 inches.
Width over side sills, 8 feet 9 inches.
Height between sill and plate, 6 feet 9 inches.
Door opening, 5 feet 6 inches.
Capacity, 30 tons.
American continuous draft gear.
M. C. B. couplers.
Westinghouse air brakes.

LUMBER.

2 side sills,	yellow pine,	5 in. x 9 in. x 33 ft. 9 in.	275 feet.			
2 center sills,	yellow pine,	5 in. x 9 in. x 33 ft. 9 in.	275 "			
4 inter. "	" "	3½ in. x 9 in. x 33 ft. 9 in.	393 "			
2 side plates,	" "	3½ in. x 7 in. x 34 ft. 8 in.	159 "			
1 ridge pole,	" "	2 in. x 4 in. x 34 ft. 8 in.	28 "			
2 purlins,	" "	2 in. x 3 in. x 34 ft. 8 in.	41 "			
1 ridge clamp,	" "	1¾ in. x 5½ in. x 34 ft. 8 in.	36 "			
6 roof ribs,	" "	1¼ in. x 2½ in. x 34 ft. 8 in.	72 "			
				1279 feet.		
6 sub sills,	short yellow pine,	5 in. x 5 in. x 6 ft. 6 in.	89 "			
2 end plates,	" " "	3 in. x 14 in. x 8 ft. 9 in.	69 "			
4 brake girths	" " "	4 in. x 9 in. x 1 ft. 1 in.	14 "			
5 cripple posts	" " "	2½ in. x 4 in. x 7 ft.	14 "			
2 door heads,	" " "	1¾ in. x 4½ in. x 5 ft. 6 in.	9 "			
1 " "	" " "	1½ in. x 4 in. x 2 ft.	2 "			
2 " stops,	" " "	2 in. x 2½ in. x 7 ft.	8 "			
1 " "	" " "	2 in. x 2½ in. x 3 ft. 8 in.	2 "			
4 " track blocks,	" "	3 in. x 3½ in. x 10 in.	8 "			
24 grain strips,	" "	1¾ in. x 3½ in. x 2 ft. 9 in.	41 "			
15 running board cleats,	"	1¾ in. x 2¼ in. x 1 ft. 6 in.	9 "			
				265 feet.		

STANDARD BOX CAR.

Detail Bill of Material in Body.

LUMBER—CONTINUED.

2 end sills,	white oak,	7 in. x 9 in. x 8 ft. 9 in.....	101 feet.		
4 draw timbers,	" "	5 in. x 8 in. x 8 ft.....	115 "		
2 " " fillers,	" "	8 in. x 9 in. x 4 ft. 3 in.....	54 "		
2 dead woods,	" "	5 in. x 9 in. x 2 ft. 8 in.....	22 "		
4 corner posts,	" "	5 in. x 5 in. x 7 ft.....	64 "		
4 door posts,	" "	4⅝ in. x 5 in. x 8 ft.....	66 "		
4 transom posts,	" "	2½ in. x 5 in. x 7 ft.....	34 "		
4 side posts,	" "	2½ in. x 4 in. x 7 ft.....	27 "		
12 " braces,	" "	2½ in. x 6 in. x 8 ft.....	140 "		
4 end posts,	" "	3 in. x 4 in. x 7 ft.....	32 "		
4 " braces,	" "	3 in. x 4 in. x 7 ft. 3 in.....	35 "		
2 cross tie timbers,	" "	4½ in. x 10 in. x 8 ft. 9 in ...	73 "		
4 side belt rails,	" "	3 in. x 3½ in. x 14 ft. 1 in..	58 "		
2 end " "	" "	3 in. x 4 in. x 8 ft. 2 in...	19 "		
11 carlines,	" "	1¾ in. x 10 in. x 8 ft. 9 in...	169 "		
8 truss rod blocks,	" "	5 in. x 5 in. x 1 ft.....	20 "		
2 king bolt "	" "	8¼ in. x 9 in. x 9 in.....	8 "		
1 cylinder block,	" "	3 in. x 14 in. x 1 ft. 7 in...	7 "		
1 reservoir "	" "	3 in. x 4 in. x 1 ft. 7 in...	2 "		
2 door track strips,	" "	1½ in. x 1¾ in. x 11 ft. 5 in..	8 "		
4 brake beams,	" "	3¼ in. x 6 in. x 6 ft.....	50 "		
				1104 feet.	
78 floor plank,	yellow pine,	1¾ in. x 6 in. x 8 ft. 9 in.....		700 "	
Lining,	" "	⅞ in. x 5¼ in.....		287 "	
Siding,	white pine,	⅞ in. x 5¼ in. 8 ft.....		868 "	
Roofing,	" "	⅞ in. x 5¼ in. 5 ft.....		400 "	
Fascia, etc.,	" "	.....		144 "	

STANDARD BOX CAR.

Detail Bill of Material in Body.

CASTINGS.

2 center plates	172 lbs.	
4 side bearings	110 "	
8 transom thimbles	17 "	
4 draft timber keys	24 "	
4 drawbar guides	23 "	
8 truss rod queen posts	100 "	
8 " " saddles	25 "	
4 " " washers (square)	38 "	
4 " " " (round)	19 "	
1 brake wheel	19 "	
1 " ratchet	6 "	
1 " pawl	2 "	
2 " mast guides	10 "	
4 side door hangers	22 "	
4 " " guides	32 "	
2 " " stops and handles	10 "	
2 end " stops and shoes	7 "	
3 " " track blocks	7 "	
20 floor washers	40 "	
24 small "	22 "	
4 pin lifter brackets	12 "	
8 brake heads	160 "	
8 " shoes	140 "	
4 " beam fulcrums	34 "	
4 " " washers	42 "	
		1093 lbs.

STANDARD BOX CAR.

Detail Bill of Material in Body.

FORGINGS.

2 body bolster top bars,	$\frac{7}{8}$ in. x 8 in. 8 ft. 9 in.....	452 lbs.
2 " " bottom bars,	1 in. x 8 in. 8 ft. 2 in.....	440 "
4 " truss rods,	$1\frac{1}{4}$ in. rd. x 36 ft. 4 in.....	576 "
2 draft rods, American continuous,	$1\frac{1}{4}$ in. x 31 ft. 6 in.....	304 "
2 " keys, " "	1 in. x 5 in. x 2 ft. 1 in.....	64 "
2 followers, " "	$1\frac{1}{2}$ in. x 6 in. x $11\frac{1}{2}$ in.....	55 "
4 angle irons, " "	1 in. x $1\frac{1}{2}$ in. x 1 ft. $2\frac{1}{2}$ in...	20 "
2 tail bolts, " "	$1\frac{3}{4}$ in. x 1 ft. 6 in.....	24 "
4 chafe irons, " "	$\frac{1}{4}$ in. x 4 in. x $10\frac{1}{2}$ in.....	11 "
2 pin lifters,	1 in.....	32 "
2 dead wood plates (face),	$\frac{3}{4}$ in. x 6 in. x 2 ft. 8 in.....	81 "
2 " " " (bottom),	$\frac{3}{4}$ in. x 5 in. x 1 ft. 7 in.....	40 "
1 carry iron, brake step,	1 in. x 3 in. x 3 ft	28 "
1 " "	1 in. x 3 in. x 2 ft	18 "
2 king bolts,	$1\frac{3}{4}$ in. x 2 ft. 8 in	42 "
2 " " plates,	$\frac{1}{4}$ in. x 5 in. x 5 in.....	2 "
1 brake mast,	$1\frac{1}{4}$ in. x 11 ft. 10 in	50 "
4 " block rods,	$\frac{5}{8}$ in. x 1 ft. $6\frac{1}{2}$ in.....	6 "
4 running board brackets,	$\frac{3}{8}$ in. x $1\frac{1}{2}$ in. x 1 ft. 1 in....	9 "
2 sill steps,	$\frac{3}{8}$ in. x 2 in. x 2 ft. 10 in....	15 "
16 grab irons,	$\frac{5}{8}$ in. x 2 ft. 8 in.....	45 "
2 side door thresholds,	$\frac{1}{4}$ in. x 4 in. x 5 ft. 6 in..	36 "
2 " " tracks,	$\frac{3}{8}$ in. x $2\frac{1}{2}$ in. x 11 ft. 5 in..	68 "
4 " " rub strips,	$\frac{1}{2}$ in. x 1 in. x 5 ft. 6 in..	14 "
1 end " threshold,	$\frac{1}{4}$ in. x 4 in. x 2 ft.	7 "
2 " " tracks,	$\frac{1}{4}$ in. x $2\frac{1}{2}$ in. x 4 ft. 6 in..	20 "
Amount carried forward.....		2459 lbs.
Total weight of body bolts		316 lbs.

STANDARD BOX CAR.

Detail Bill of Material in Body.

FORGINGS—CONTINUED.

Amount brought forward			2459 lbs.
8 corner bands,	$\frac{3}{8}$ in. x $2\frac{1}{2}$ in. x 1 ft. 6 in.	36 lbs.	
7 roof rods,	$\frac{5}{8}$ in. x 9 ft. 2 in.	64 "	
30 post and side rods,	$\frac{3}{4}$ in.	314 "	
30 " rod washers,	$\frac{1}{4}$ in. x $2\frac{1}{2}$ in. x $2\frac{1}{2}$ in.	12 "	
			462 lbs.
8 brake shoe keys,	$\frac{1}{2}$ in. x $\frac{7}{8}$ in. x $9\frac{1}{2}$ in.	8 lbs.	
8 " beam guides,	$\frac{7}{8}$ in. x 1 ft. 2 in.	18 "	
8 " " truss rods,	$\frac{5}{8}$ in. x 6 ft. $4\frac{1}{2}$ in.	48 "	
4 " " fulcrums,	$\frac{3}{4}$ in. x $2\frac{1}{2}$ in. x 1 ft. 10 in.	36 "	
8 " hangers,	$\frac{7}{8}$ in. x 1 ft. 6 in.	52 "	
8 " " eyes,	1 in. x 1 ft. 4 in.	26 "	
8 " safety chains and eyes,	$\frac{1}{2}$ in. x 4 ft. 2 in.	33 "	
2 dead lever anchors,	$\frac{7}{8}$ in. x 2 ft. 4 in.	34 "	
1 push rod and jaws,	$1\frac{3}{8}$ in. x 2 ft. 8 in.	22 "	
2 top rods " "	$\frac{3}{4}$ in. x 9 ft. 6 in.	59 "	
1 cylinder rod and jaws,	$\frac{3}{4}$ in. x 7 ft. 6 in.	26 "	
1 hand rod " "	$\frac{3}{4}$ in. x 11 ft. 2 in.	24 "	
2 bottom rods " "	$\frac{7}{8}$ in. x 5 ft.	50 "	
2 release rods,	$\frac{3}{8}$ in. x 4 ft. 9 in.	3 "	
2 live levers,	1 in. x $3\frac{3}{4}$ in. x 2 ft. 6 in.	58 "	
2 dead levers,	1 in. x $3\frac{3}{4}$ in. x 2 ft.	44 "	
1 cylinder lever,	1 in. x $3\frac{1}{4}$ in. x 2 ft. 11 in.	32 "	
1 reservoir "	1 in. x $3\frac{1}{4}$ in. x 2 ft. 8 in.	28 "	
1 " fulcrum,	$\frac{1}{2}$ in. x $2\frac{1}{2}$ in. x 3 ft. 4 in.	14 "	
3 lever guides,	1 in. x 3 ft. $7\frac{1}{2}$ in.	27 "	
19 connection pins,	$1\frac{1}{8}$ in. x $4\frac{1}{2}$ in.	21 "	
5 pipe clamps and hangers,	$\frac{1}{2}$ in. x $1\frac{1}{2}$ in.	13 "	
			676 lbs.
			3561 lbs.
Rough weight of iron			3743 "

STANDARD BOX CAR.

Detail Bill of Material in Body.

SUMMARY.

Long yellow pine	1279	feet.
Short " "	265	"
Oak	1104	"
Flooring, yellow pine	700	"
Lining " "	287	"
Siding, white pine	868	"
Roofing, " "	400	"
Fascia, etc., white pine	144	"
Wrought iron forgings	3743	lbs.
" " bolts	316	"
Cast iron	1093	"
Couplers, M. C. B.	2	
Draw springs	2	
Brake chain	3	lbs.
Turnbuckles, Cleveland	4	
Door locks "	3	
Corner irons, pressed steel	4	
Chicago roof, iron	1	
Air brake equipment	1	
Train pipe and fittings.		
Square nuts	121	lbs.
Wrought washers	20	"
Wire nails	84	"
Screws	1	gross
Paint material	11	gals.
Labor.		

STANDARD FLAT CAR.

Detail Bill of Material in Body.

DIMENSIONS.

Length over end sills, 34 feet 8 inches.
Width over side sills, 8 feet 9 inches.
Capacity.
American continuous draft gear.
M. C. B. couplers.
Westinghouse air brakes.

LUMBER.

2 side sills, yellow pine,	5 in. x 12 in. x 35 ft.	375 feet.	
2 center sills, " "	5 in. x 9 in. x 33 ft. 9 in.	275 "	
4 inter. " " "	3½ in. x 9 in. x 33 ft. 9 in.	393 "	
			1043 feet.
2 cross ties, short yellow pine,	4½ in. x 10 in. x 9 ft.	73 "	
6 sub sills, " " "	5 in. x 5 in. x 6 ft. 9 in.	91 "	
4 truss blocks, " " "	5 in. x 5 in. x 4 ft. 6 in.	10 "	
4 " " " " "	5 in. x 5 in. x 3 ft.	7 "	
4 brake " " " "	4 in. x 9 in. x 4 ft. 6 in.	15 "	
			196 feet.
2 end sills,	white oak, 7 in. x 9 in. x 9 ft. 6 in.	112 "	
4 draw timbers,	" " 5 in. x 8 in. x 8 ft.	116 "	
2 dead woods,	" " 6 in. x 8 in. x 2 ft. 9 in.	24 "	
2 draw timber fillers,	" " 8 in. x 9 in. x 4 ft. 5 in.	56 "	
2 king bolt blocks,	" " 8 in. x 8¼ in. x 10 in.	10 "	
4 brake beams,	" " 3¼ in. x 6 in. x 6 ft.	50 "	
			368 feet.

Long yellow pine	1043 "
Short " "	196 "
Flooring, yellow pine	700 "
White oak	318 "

STANDARD FLAT CAR.

Detail Bill of Material in Body.

FORGINGS—CONTINUED.

Amount brought forward			2170 lbs.
8 brake shoe keys,	½ in. x ⅞ in. x 9½ in.	8 lbs.	
8 " beam guides,	⅞ in. x 1 ft. 2 in.	18 "	
8 " " truss rods,	⅝ in. x 6 ft. 4½ in.	48 "	
4 " " fulcrums,	¾ in. x 2½ in. x 1 ft. 10 in.	36 "	
8 " hangers,	⅞ in. x 1 ft. 6 in.	52 "	
8 " " eyes,	1 in. x 1 ft. 4 in.	26 "	
8 " safety chains and eyes,	½ in. x 4 ft. 2 in.	33 "	
2 dead lever anchors,	⅞ in. x 2 ft. 4 in.	34 "	
1 push rod and jaws,	1⅜ in. x 2 ft. 8 in.	22 "	
2 top rods " "	¾ in. x 9 ft. 6 in.	59 "	
1 cylinder rod and jaws,	¾ in. x 7 ft. 6 in.	26 "	
1 hand rod " "	¾ in. x 11 ft. 2 in.	24 "	
2 bottom rods " "	⅞ in. x 5 ft.	50 "	
2 release rods,	⅜ in. x 4 ft. 9 in.	3 "	
2 live levers,	1 in. x 3¾ in. x 2 ft. 6 in.	58 "	
2 dead levers,	1 in. x 3¾ in. x 2 ft.	44 "	
1 cylinder lever,	1 in. x 3¼ in. x 2 ft. 11 in.	32 "	
1 reservoir "	1 in. x 3¼ in. x 2 ft. 8 in.	28 "	
1 " lever fulcrum,	½ in. x 2½ in. x 3 ft. 4 in.	14 "	
3 lever guides,	1 in. x 3 ft. 7½ in.	27 "	
19 connection pins,	1⅛ in. x 4½ in.	21 "	
5 pipe clamps and hangers,	½ in. x 1½ in.	13 "	
			676 lbs.
			2846 lbs.
Total weight of body bolts			260 "

STANDARD FLAT CAR.

Detail Bill of Material in Body.

SUMMARY.

Long yellow pine	1043	feet.
Short " "	196	"
White oak	368	"
Flooring, yellow pine	700	"
Wrought iron forgings	2846	lbs.
" " bolts	260	"
Cast iron	975	"
Couplers, M. C. B.	2	
Draw springs	2	
Turnbuckles, Cleveland	4	
Brake chain	3	lbs.
Air brake equipment	1	
Train pipe and fittings.		
Square nuts	81	lbs.
Wrought washers	19	"
Wire nails	40	"
Paint material	1½	gal.
Labor.		

COAL CAR.

EXTRA MATERIAL REQUIRED FOR 42-INCH COAL SIDES.

Side plank, yellow pine	893	feet.
" stakes, white oak	185	"
Wrought iron	283	lbs.
Square nuts	26	"
Wrought washers	9	"
Paint material	3	gals.
Labor on side plank.		

ONE PAIR OF STANDARD TRUCKS.

60,000 Pounds Capacity, Rigid Trucks.

2 truck bolsters,	9 inches x 12 inches x 7 feet 6 inches	148 feet.
2 " spring plank,	5 " x 12 " x 7 " 6 "	82 "
4 top arch bars,	1¼ inches x 4 inches x 6 feet 4 inches	392 lbs.
4 bottom arch bars,	1⅛ " x 4 " x 6 " 10 "	388 "
4 tie bars,	⅝ " x 4 " x 6 "	188 "
4 bolster truss rods,	1⅛ " x 8 feet 4 inches	108 "
8 oil boxes, M. C. B.		704 "
8 truck columns		332 "
8 " " guides		84 "
2 center plates		146 "
4 side bearings		79 "
4 truss rod saddles		95 "
4 " " end plates		84 "

SUMMARY.

White oak lumber	230 feet.
Wrought iron forgings	1156 lbs.
" " bolts	201 "
Square nuts	44 "
Cast iron	1524 "
Wheels, M. C. B., 600 lbs., 33 inches	4800 "
Axles, " " " 4 inch x 7 inch journal	1860 "
Brasses, " " " 4 " x 7 inch, solid	100 "
Oil box wedges, malleable	56 "
" " covers, pressed steel.	
Bolster springs, Pennsylvania Y.	
Oil and waste.	
Labor.	

ONE PAIR OF STANDARD TRUCKS.

Swing Motion, 50,000 Pounds Capacity, Channel Bars.

LUMBER.

2 truck bolsters,	9 inches x 11½ inches x 5 feet 4 inches.	99 feet.	
2 " spring plank,	3 " x 11 " x 5 " 4 "	33 "	
8 dust guards,	⅝ " x 6 " x 9¼ inches.....	3 "	
			135 feet.

CASTINGS.

8 oil boxes	626 lbs.	
8 " " covers, "Hewitt"	50 "	
4 hanger bearings, bottom	50 "	
4 " "	57 "	
8 chafe plates	62 "	
		845 lbs.

MALLEABLE CASTINGS.

4 truck ends	280 lbs.	
2 center plates	70 "	
4 side bearings	40 "	
8 hanger pin bearings, top	38 "	
8 oil box wedges	34 "	
		462 lbs.

FORGINGS.

4 top arch bars,	1⅛ inches x 4 inches x 6 feet	349 lbs.	
4 bottom arch bars,	1 " x 4 " x 6 "	331 "	
4 tie bars,	½ " x 4 " x 6 "	154 "	
4 swing hangers,	¾ " x 4 " x 6 "	168 "	
4 " " pins,	1¾ " x 1¾ " x 2 " 2 inches	72 "	
			1074 lbs.

BOLTS.

8 arch bar and truck ends,	1 inch x 1 foot 6 inches	33 lbs.	
16 " " " oil boxes,	1 " x 1 " 2 "	54 "	
8 bolster and center plates,	¾ " x 11¾ inches	13 "	
8 " " side bearings,	⅝ " x 9¾ "	7 "	
16 " " chafe plates,	½ " x 3 "	2 "	
			109 lbs.
72 rivets for channel bars,	¾ inch x 2½ inches		31 "

ONE PAIR OF STANDARD TRUCKS.

Swing Motion, 50,000 Pounds Capacity, Channel Bars.

SUMMARY.

Lumber, white oak	135	feet.
Cast iron	845	lbs.
Malleable castings	462	"
Wrought iron forgings	1074	"
" " bolts	109	"
" " rivets	31	"
Cast wheels, 33 inches, 600 lbs	4800	"
Scrap axles, journal 4 inches x 7 inches, ctr. 4¼ inches	1525	"
Brasses, solid	76	"
Channel bars, ½ inch x 10½ inches x 6 feet 7 inches	568	"
Bolster springs, Pennsylvania W	259	"
Square nuts	51	"
Hexagon nuts	24	"
Washers, ¾-inch	½	"
Lag screws, ½ inch x 3½ inches	8	
Flat-head screws, 2½-inch, No. 18	16	
Cotters, ⅝ inch x 2½ inches	8	
Split keys, ½ " x 2½ "	14	
Oil, lubricating	6½	gal.
Cotton waste	13	lbs.
Paint material	1	qt.
Labor.		

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